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THE TELEPHONE ON TOP.

Another "thirty years' war" may be said to have just ended, in the passing of the control of the Western Union Telegraph system into the hands of the management of the American Telephone & Telegraph. The announcement of the change came almost 30 years to a day after the signing of the famous contract of Nov. 10, 1879, under which the Western Union Company gave up the 85 telephone exchanges it had already created in opposition to the Bell and withdrew from the field. At the time, it seemed to have the best of the bargain. In return for its voluntary retirement from the telephone field it received a royalty of 20 per cent of all the Bell telephone earnings while the Bell patents ran, and thus came to enjoy an annual income of several hundred thousand dollars for agreeing simply to sit still, with folded hands. Moreover, it has had a lump sum of several millions added to that under settlement of a dispute as to what that clause meant. In addition, it got a neat sum in cash for its Edison, Gray and Phelps apparatus. Further, it secured 40 per cent of the stock of the local telephone systems of New York and Chicago. Finally, to satisfy the Gould appetite, the Bell interests agreed to stay out of the telegraph field.

We are now witnessing the dramatic epilogue to that transaction, and see the telephone interests which were thus "trimmed" so unmercifully return after three short decades and take virtual possession of the concern that mulcted them. It may be said that in purchasing less than a 30 per cent interest from the Gould and Sage estates, the Bell interests do not secure a majority control; but that has never been necessary even back to the time when Gould ousted the Vanderbilts from ownership, for the reason that the stockholding has always been of a scattered character. It is obvious that the telephone people can really do anything they like with the property, short of wrecking it, and they will not do that. The press has been swift to assume the existence of a general telegraph and telephone merger; but in fact there is nothing of the kind. It is true that Mr. Mackay or his company is a large holder of telephone stock, but this is not an alliance, though it may be an entanglement. The Postal Telegraph system remains free, separate and distinct, and, for aught we can see to the contrary, may go on competitively active for many years to come. We hope it will. But there is nothing in the situation to justify the prolonged rumors as to "vast merger" and "big monopoly," although there may come an adjustment of which both the telephone and telegraph industries have stood in need, as to circuits, offices, rates and other matters that affect the public.

For a long time past the telegraph has been relatively becoming more insignificant, while its profit as an enterprise has shrunk visibly from year to year. Much of this may be

attributed to lack of managerial courage and ability, but a great deal has doubtless been due to the sapping of the telephone, which has rapidly taken business away from the telegraph just as the interurban trolleys have taken passenger traffic away from the steam railroads. According to some of the stories, heads are to go off wholesale in the telegraph ranks; while the real truth is that no one will welcome the change so heartily as the live men still left in telegraphy. With the two systems of operation brought into closed touch, efficiencies and economies undreamed of can be attained. Numberless small offices carried on at a loss can be wiped out; circuits can be interchangeably worked, and the saving with one set of construction gangs instead of two may be characterized as simply enormous. The public will gain by having a telegraph wire practically in every house and office, besides gaining in time of message delivery, for it is notorious that the delays do not come on the wire, but in handling dispatches before and after transmission. All this should involve further benefit in a lowering of rates, and probably will.

Some aspects of the "deal" can hardly be discussed at this juncture; not enough is known of all the sides of the transaction. One or two points may be assumed. The first is that while there is no general merger, a most friendly *entente cordiale* exists between the three great systems affected. The second is that if a vast monopoly were attempted, the Government would have something to say about it; but it does not follow that such a unification would necessarily be bad. The third patent inference is that the development of independent telephony must be rather vitally affected. That competition has done wonders, but it has already lost its initial motive and impulse and has itself entered on the path of big consolidations tending to create a fourth big system. When that system comes finally into existence it must co-operate with the other three or go under.

Marine Propulsion.

The application of steam turbines to marine work was not welcomed with any great enthusiasm by naval architects and marine engineers. In fact, the keenness of competition for ocean passenger traffic, rather than considerations of a kind that have influence with professional men, has been the deciding factor in many decisions of steamship companies to discard the older for a newer type of vessel or equipment; and when one company adopts the latest "modern" improvement other companies are constrained to follow its lead in order to retain their standing with ocean travelers. The public then naturally expects the designers of war vessels to follow suit, if in its opinion a new system thus adopted would improve such vesels; and in case of hesitancy to act, the newspapers add the weight of their authority, deplore the inefficiency of naval designing bureaus, and rally politicians to the navy's need. That the steam turbine in its present form is not the ideal means of propulsion that has been asserted by its advocates for marine use, follows in great part from the very reason that makes this prime mover ideally applicable to electrical generation, namely, its inherent high speed. The efficiency of marine propellers is vitally dependent upon the efficiency of the screw propeller, and this in principle has a descending value at speeds beyond a critical one. The principal problem in this branch of engineering has thus been to adapt, directly or indirectly, the steam turbine to an efficient speed of propeller shaft.

It is a matter of no small gratification that the only solutions to the problem thus far offered and which are presented almost coincidentally, are both connected with names closely identified with the electrical industry. Moreover, both are presented, not as suggestions having to wait development, but in a state of elaboration which enables their immediate application aboard ship. One of these, the invention of Rear Admiral George W. Melville and Mr. J. H. McAlpine, has been developed through the agency of Mr. George Westinghouse, and consists of a remarkably interesting helical gearing arrangement between the turbine and propeller shaft, whereby the speed of the latter is reduced to that corresponding to the highest propulsive efficiency. That the invention is a remarkable one is obvious when we learn that in experimental operation the gearing has transmitted 6000 hp under practical working conditions at an efficiency of 98.7 per cent, the revolutions being reduced in the ratio of 5 to 1. The design of an arrangement capable of transmitting quietly and without destructive wear such enormous power at almost negligible loss is certainly a great achievement, which will still further enhance the reputation of the masters of marine engineering design to whom it is due.

The second solution forms the subject of a paper read by Mr. W. L. R. Emmet, of the General Electric Company, at a meeting in New York last week of the Society of Naval Architects and Marine Engineers. This is purely an electrical method, and while, in view of many previous suggestions along similar lines, it is not novel in conception, the system has been worked out in full engineering detail for immediate application to war ships. As will be seen from an abstract of Mr. Emmet's paper, printed elsewhere, the plan involves the installation aboard ship of a steam turbine electrical generating station for the supply of power to electric motors driving the propeller shafts. In both of these systems not only are conditions of the highest generating economic and propulsive efficiency secured, but a great saving of machinery weight is effected—a consideration of the highest importance, since it involves an advantage in speed, or cruising radius, or thickness of armor, or gun equipment.

The Single-Phase Induction Motor at No-Load.

The main operating features of the single-phase induction motors are not difficult of comprehension by one familiar with the polyphase induction motor. On the other hand, the secondary features, which differ essentially from those found in the polyphase machine, have given rise to numerous contentions among persons well informed concerning the phenomena of the latter. These secondary features, as existing in the machine operating without load, are treated in great detail in an instructive article by Mr. Val A. Fynn, the second and concluding part of which appears in this issue. In the earlier section the author dealt with the secondary and tertiary currents in the rotor, and their reflected values in the primary circuits, while in the present issue he discusses the fluctuating rotor torque and shows in what way this torque affects the flow of

energy supplied to the primary. Since the torque fluctuates at double the circuit frequency, it would seem that a rotor of any appreciable weight would be unable to vary its speed to any marked extent in conformity therewith, so that for all practical problems one can safely assume a uniform rotative speed. However, a complete analysis of the internal action of the single-phase motor is of much value from an instructional point of view, and the author is to be commended for the thoroughness with which he has completed the task undertaken by him. The representation by the author of the secondary of the motor as the armature of a commutator-type machine may lead to some confusion at first glance, but a little study will show that the commutator arrangement with short-circuited brushes is the equivalent of the squirrel-cage single-phase induction motor. The representation possesses the advantageous features of allowing the characteristics of the machine to be investigated with the maximum of simplicity, and to be compared most readily with those of single-phase machines in which use is actually made of commutators.

A New Type of Exploring Coil for Use with Underground Cables.

Ever since cables of insulated wires were first laid underground, which is more than 50 years ago, means had to be found of identifying individual conductors, for the purposes either of orderly connection or of disconnection for repairs. The earliest underground cables consisted of gutta-percha covered copper wires, about 1 mm in bare diameter, used for telegraphy. In order to identify the individual conductors it became customary to apply a few volts at the station to the particular conductor required, and for the wireman at the manhole to use a galvanoscope as a detector. He grounded one terminal of this galvanoscope, and, with a pin connected to the other terminal, pierced the gutta-percha envelope of each wire in turn, until he found a current flowing through the galvanoscope. This process of pricking pinholes in the insulation soon led to the development of faults at the manholes, even when an effort was made to seal up and mend the pinholes with the aid of a hot jointing-tool. Even the low-tension systems of those days would not tolerate such injurious practices. The pinsticking habit had to be prohibited, but the necessity for identifying wires was so great that pinholes frequently developed into faults after it had become a general order to dismiss linemen convicted of pin pricking. It was only after an electromagnetic method of identifying wires had been developed that the foregoing objectionable method entirely disappeared. The magnetic method employed a galvanoscope with a needle suspended in such a manner that each wire could in turn be inserted close to the suspension without cutting the wire. Either a steady current, or a current applied at successive, regular short intervals, then produced a deflection on the galvanoscope that was readily detected.

Later on, when telephone cables were introduced, identification of wires was effected partly by color variations in the coverings, and partly by electromagnetic devices. An exploring coil was introduced, consisting of a secondary winding connected to a head telephone, the primary winding being the particular wire of the cable, on which a rapidly fluctuating voltage was impressed at the station. By listening to each wire in turn, the wireman could identify the particular wire carrying the testing current. When electric light cables came into use, the conductors were too heavy to subject to the treatment previously imposed by such methods, and new devices had to be arrived at. In most cases the number of conductors in a single cable was limited to three, so that the identification problem became of lesser importance; while the cables, when numerous, occupied individual ducts in a conduit, readily permitting of identification, either from records or from a regular plan of construction. In place of the identification problem, however, there arose the fault-localization problem. If a ground occurred, the fault was hard to localize electrically, because of the low linear resistance of the large conductors, and of the large error in distance that a small electrical error in localization-resistance entailed. Once more the plan of sending a readily recognizable type of current from the station over the faulty wire was resorted to, with some means of detecting this current electromagnetically, either at the surface of the cable-trench or in the manholes. When a large current could be sent into the faulty cable, and the current could be forced to distribute itself through the ground at the fault, a compass needle placed on the ground surface has often served to detect the current impulses along the line of cable up to the fault, these impulses disappearing after the fault had been passed. Or, an exploring coil might sometimes be employed with advantage in a similar manner.

With the introduction of high-tension cables in continuous leaden sheaths, new difficulties arose in the application of the above methods, owing to the return of a large portion of the outgoing current through the sheath, and the cancellation thereby of a large part of the magnetic field produced by the current of identification. In this week's issue, Mr. William A. Durgin describes a new type of exploring coil, in which the winding is laid transverse to the cable, and the core parallel to the cable. It depends for its application upon the fact that the conductors in all three-wire cables are, in practice, laid up helically with a lay of some 20 in. By using one pair of the three conductors as the conducting loop, over which testing currents are sent from the station, the magnetic field due to sheath currents or to currents through neighboring cables in the conduit is eliminated, and only the transverse field component due to the lay of the spiraled conductors in the cable tested is brought into action. This is a very ingenious method, although it calls for a relatively powerful identification current in the conductors. It would probably be impracticable to apply this exploring coil except close to the cable examined, so that all tests made from the surface of the ground over the cable trench must be given up. Since, however, in each manhole the wireman can bring the coil into close proximity to each cable in turn, and since, in practice, it is only necessary to locate a fault in a cable between adjacent manholes, so as to be able to draw out the defective section and replace it by a sound section, the need for a device that will indicate at the street surface is much lessened. The old Latin proverb said in effect that he gives doubly who gives promptly, and it may certainly be said, in imitation thereof, that he repairs doubly who localizes a fault promptly in power-distribution work. Every practicable device for such purpose should be widely made known.

Bell Telephone and Western Union.

The announcement that the American Telephone & Telegraph Company had purchased a large interest, the Gould holdings, in the Western Union Telegraph Company, was made in our last issue. This deal, while not involving direct majority control, is now said to give the practical control of the Western Union to the telephone company. Recent acquisitions amount to about 280,000 shares, or 28 per cent of the outstanding $99,787,000 of capital stock of the Western Union. It is also stated that previous to this purchase the telephone company had taken over other holdings, and that at this time it controls, directly or indirectly, a voting majority of the outstanding stock.

Official announcement of the deal was first made by Mr. Theodore N. Vail, president of the American Telephone & Telegraph Company, who said that his company had obtained control of "a substantial minority interest" in the shares of the Western Union. He said: "From the very commencement of the telephone business it has been thought that a close corporation, the making of one business an auxiliary to the other business, would give additional public service, as well as result in larger economies both to the public and to the companies. This is the reason for our acquisition of Western Union stock. There is much to be gained by joint construction and maintenance of plant and by its common use to the greatest possible extent, but the greatest advantage would follow the placing of the millions of telephone subscribers in close and reliable connection with the receiving and dispatching offices of the telegraph companies. While some provision for this, after a manner, exists to-day, the lack of harmony and co-operation between the companies, and the inability to agree on methods of fixing responsibility have limited its utilization to cases of absolute necessity. The harmony and co-operation necessary, it is believed, can now be established and the resulting advantages may be available for the public. While there is a common feature in the use of wires strung on poles or in cables, the similarity ends there. The circuits and methods used for the telegraph and the telephone are entirely distinct and different, and each business requires especial equipment, operating forces and general business organization. It seems not only to be good policy, but a duty to increase the service and advantages to the public by utilizing present unutilized business, and at the same time benefit property and increase revenue."

In a further statement several days later Mr. Vail said: "It will be possible in many places to have the telegraph and telephone business in the same or an adjoining building, so that the sender of a message may forward his dispatch by telephone without the necessity of using messenger service. As far as I can see, there is no occasion for an investigation by the Government. We have been feeling our way, and in my opinion there could be no valid reason for Federal action. There has been no merger of rival and competing companies, and the action we have taken is merely the acquirement of stock in a telegraph company by our corporation. There are to be no changes in the official management of the companies, although we hope to elect some of our representatives to the board of directors of the Western Union. No new financing on our part will be necessary, as the Western Union stock was purchased with treasury funds."

Mr. George J. Gould admitted the sale of the holdings of his family to the American Telephone & Telegraph Company, and said: "I believe this will inure to the benefit of both the public and the Western Union stockholders, as the business of both companies can be handled so that they form a complement to each other, thus giving to the fullest extent prompt and satisfactory service to their patrons." Mr. Gould did not state the amount paid for his holdings, but it is generally understood in Wall Street that the price was about $85 per share.

There were many reports concerning the deal in the financial district, one of the most persistent being that the American Telephone & Telegraph Company would soon make a contract with the Western Union Company by which it would guarantee dividends on the stock of the latter company. The Western Union is now paying at the rate of 3 per cent, but during the latter half of 1908 and the first half of 1909 it only paid at the rate of 2 per cent. It formerly paid 5 per cent. The American Telephone & Telegraph Company has been a regular dividend payer for a number of years at the rate of 8 per cent.

For many years a suit has been pending between the two companies involving royalties upon telephone patents. During the summer a special master in chancery decided that the American Telephone & Telegraph Company owed to the Western Union Company about $6,000,000. This decision was appealed, and the case will finally be carried to the United States Supreme Court. In regard to this Mr. Vail said: "The so-styled suit between the Western Union and the Bell interests has been decided twice in favor of the Bell company and once partially in favor of the Western Union. It has been in the courts now 28 years, and it will be appealed. The suit in reality is against the American Speaking Telephone Company, which was organized by the Gold & Stock Telegraph Company, as a subsidiary of the Western Union, and the Harmonic Telegraph Company, a company organized by Dr. White, of Pennsylvania, to exploit Professor Gray's telegraph patents." The recent transactions in stock will have no effect upon this litigation, according to Mr. Vail's statements.

The purchase of the control of the telegraph company by the telephone company gave rise to many rumors that a telegraph merger was contemplated which would involve the Mackay Companies, as well as the Western Union. This opinion was given special strength from the fact that the largest individual stockholder in the American Telephone & Telegraph Company is the Mackay Companies. Mr. Vail, however, made explicit denial that any merger of telegraph companies was contemplated at this time. He declared that the purchase by the telephone company was chiefly to improve the service, and had nothing to do with any other telegraph companies. In this connection, Mr. Clarence H. Mackay, president of the Mackay Companies, made this statement: "We have had nothing to do, either directly or indirectly, with the combination of the American Telephone & Telegraph Company with the Western Union Telegraph Company. We have not wished to join it, and have not been invited to join it. There have been no negotiations whatsoever with us in regard to the matter, and there is every reason why we should not have had anything to do with it. We knew nothing about it until the day when it was publicly announced.

"It is true that we own a large block of stock in the American Telephone & Telegraph Company, but we never have had and have not now any representation on the board of that company, and our stock is not consulted or considered any more than the stock of any other stockholder, as you will see from the fact that we knew nothing about this deal until it was publicly announced. Neither have we had anything to do with the purchase of telephone companies in the Middle West. Our company is slow and conservative in its investments, but aggressive in its service. We are not disturbed in any way. We have successfully met hard competition for over 25 years and have prospered, and are in first-class financial condition, better than ever before. Competition will continue, and it will be real competition the same as heretofore."

The effect of this deal upon the stocks of the two companies was not particularly important. For several days prior to the announcement of the sale Western Union stock had advanced, and had been particularly active. During the week which succeeded the announcement the stock receded in price, and practically lost all of its gain. The effect upon American Telephone & Telegraph Company stock was to push it up two points. There has been some increase of activity in both stocks since the deal became known. It has been both asserted and denied that the Federal Government has taken steps toward an investigation of the details of the transaction, with a view to action should there appear to exist a combination against the interests of the public.

Merging of Municipal and Underwriters' Electrical Inspection.

Commissioner O'Brien, of the New York City Department of Water Supply, Gas and Electricity, has concluded a working agreement with the New York Board of Fire Underwriters, to go into effect Dec. 1, whereby the commissioner will certify, and therefore legalize, the certificates of the New York board for electrical equipments installed in premises involving fire risks only, such as private buildings and small stores. The New York board certificate thus endorsed by the department becomes legally the latter's own certificate. It will be necessary, however, for all persons installing electrical wiring or appliances in the city to continue to file the usual application for inspection, as, in order to keep legal control of the situation, the department will decline to place its certification upon an underwriters' certificate unless the usual application for inspection shall have been filed with the Bureau of Electrical Inspection. The agreement makes exceptions of equipments in buildings owned or controlled by the city, theaters, moving-picture machine establishments, churches and other places of public assemblage where it is believed that a panic, as well as a fire hazard, may exist. In the case of these buildings the department's individual certificate will be required as formerly.

Incident to the establishment of this working agreement a joint advisory board of engineers has been constituted, consisting of Messrs. Lacombe, Sever and Wynkoop, for the city, and Messrs. Stewart, Forsyth and Bruen, for the New York Board of Fire Underwriters. The purpose of this advisory board is to consider and report on all matters relating to the electrical inspection service in the City of New York. Since these reports will be prepared in duplicate, one copy being submitted to the Commissioner of Water Supply, Gas and Electricity, and the other to the head of the New York Board of Fire Underwriters, a uniformity of rules, interpretations, approvals and inspection methods, which has not existed hitherto, may now be anticipated.

Secretary of the A. I. E. E. on Tour of Middle West.

At a meeting of the board of directors of the American Institute of Electrical Engineers held Nov. 12, Mr. Ralph W. Pope, the secretary of the Institute, was authorized to make a tour of the Middle West. Mr. Pope left New York on Nov. 14, going direct to Urbana, Ill., where he addressed the Urbana Section of the Institute. On Nov. 16 he visited the Chicago Section, the principal speaker at that meeting being Dr. Steinmetz. From Chicago Mr. Pope proceeded to Madison, Wis., and thence went to St. Paul, at which city he presented Dr. Cary T. Hutchinson's recent paper on the electric system of the Great Northern Railway Company at Cascade Tunnel. The secretary will also visit the Iowa State Section at Ames, Ia., and returning will address the Fort Wayne Section. Mr. Pope expects to be at his desk again on Nov. 29. This tour promises to be no less beneficial to the Institute than a recent one by Mr. Pope to the Far West, through the extension of the personal acquaintance of the permanent officer of the body among the membership.

Proposed Railroad Terminal Electrification in Chicago.

The subject of compelling the railroads in Chicago to electrify their lines within the city limits has reached the stage of public hearings, and the first meeting of this character was held by the local transportation committee of the City Council on Nov. 17. Representatives of the railroads and railroad trainmen were heard on the one side, while on the other speakers for the people of Chicago presented their case. The proposed ordinance was first read. It provides that within six months after its passage the railroads must submit plans to operate their lines within the city of Chicago by means other than steam and without the production of steam, noxious gases or noxious vapors. It is also stipulated that by Jan. 1, 1912, all trains must be operated by means other than steam on penalty of a fine of $200 a day.

The first speaker was Mr. P. J. Calkins, representing the Brotherhood of Locomotive Engineers, who said that the railroads and their employees were doing their best to abate the smoke nuisance. He could see no reason for the ordinance, against which he protested vigorously. Electrification in New York, he said, has resulted in loss of life and injuries to trainmen. Furthermore, the Chicago situation is very different from that in New York. Many locomotive engineers live here, and they would have to leave the city if the railroads electrified, for their occupation would be gone. To do away with a little smoke, it is proposed to imperil the lives of many men employed on the railroads. The end does not justify the means.

As a representative of the Anti-Smoke League, Judge A. N. Waterman addressed the committee. He pointed out that every great reform has been strenuously, even violently, opposed. The locomotive engineers are entitled to consideration and so are the mine operators and the dealers in soft coal. Nevertheless, the soft-coal burning locomotives constitute a great nuisance, and the speaker made a plea for the homes of the people constituting the community of 2,000,000 men, women and children in Chicago.

For the Illinois Central Railroad, Mr. Blowett Lee, a lawyer, suggested some modifications of the ordinance. He said that the railroads of Chicago were so interlinked by interchange of traffic that the subject of electrification should be considered by all of them together and not by any one railroad. He thought also that the time limit of the ordinance, Jan. 1, 1912, gave altogether too short a time to make such an extensive improvement. The penalty of $200 a day he also thought excessive. The proposed ordinance apparently prohibits the burning of hard coal or coke to get smokeless operation, as it expressly mentions noxious gases and vapors, as well as smoke; the speaker thought that this should be modified. Furthermore, he was of the opinion that the measure should only apply to thickly populated districts, and that no hardship would result if steam locomotives were permitted in the outlying parts of the city.

Mr. A. P. Kelly, vice-grand-master of the Locomotive Firemen's Union, made a witty speech, in which he opposed the proposition. He said that smoke was not unhealthful, and offered himself in evidence of this fact. He said that he had "fired" for 15 years, and as he is a sturdy man, weighing perhaps 250 lb., he put himself in as an exhibit. The firemen, according to Mr. Kelly, are very much opposed to the electrification proposition. The speaker referred to the dangers of railroading, and said that electrification would increase them tenfold. He repeatedly referred to the Anti-Smoke League as the "ladies' society." Hard coal is used on the switching locomotives in New York City, and if used in Chicago would prevent smoke.

Mrs. F. G. Culver represented the Outdoor Art League, and she was followed by Mr. W. A. Gardner, vice-president of the Chicago & Northwestern Railway, who read a paper giving many interesting details of practical railroad operation in Chicago. The railroads, he said, are bound up intimately with the industrial and commercial life of the city, and it will be impossible to effect this great change without affecting the business interests. The Northwestern Railroad alone has approximately 375 miles of track in the city, and it has never less than 10,000 freight cars on these tracks. Considering all the railroads, 2000 passenger trains enter and depart from the city every day, and there is a movement of no less than 65,000 freight cars in and out of Chicago daily. The change proposed in the ordinance is a revolution, and should receive very careful and long-continued investigation. Conditions in New York and Chicago are very different. For instance, there are 13,000 track

switches in Chicago, and every one of them means a complication of the electrification problem. The speaker opposed electrification. He said that his company makes some smoke, but less than it ever made before, and it promises to make still less in the future. Smokeless coal is used, for which the company pays $3.05 a ton, although Illinois soft coal could be bought for $1.70.

Mrs. John B. Sherwood, from the Chicago Women's Club, made an earnest plea for a cleaner Chicago, and at the conclusion of her speech the chairman of the committee announced that others desiring to be heard would be given an opportunity at the next hearing, the time of which was not announced.

Ohio Independent Telephone Situation.

Mr. F. R. Huntington, vice-president of the Huntington National Bank, of Columbus, Ohio, has closed negotiations for the purchase of a controlling interest in the Columbus Citizens' Telephone Company, the large independent plant of Ohio's capital city. This includes the lease of the Franklin County Telephone Company also. Mr. Huntington has refused to state the principals behind him in this deal, but the general supposition is that the interests are the same as are involved in the purchase of the United States, Toledo Home and Cuyahoga Telephone companies in Ohio, and the New Long-Distance Telephone Companies of Indiana, which are represented by James S. Brailey, Jr., of Toledo. The cost of the controlling interest is said to be about $1,500,000.

Mr. Frank A. Davis, president of the company, stated that Mr. Huntington had assured him that the interests for whom he is acting will continue the company as an independent organization. He had been asked, he said, to continue as president of the company, and that he thought the other officers and the directors will be continued as they are. He said the owners had received what they consider a good price for their holdings, but that further than this they could say nothing at this time. Mr. Frank L. Beam, president and manager of the Ohio Independent Telephone Association, is a member of the board of directors of the Columbus Citizens' Telephone Company. He said he felt sure that this and the other companies purchased recently would be continued on an independent basis. The company was owned mostly by local men in Columbus. It was promoted, with others, by the Everett-Moore syndicate, but the stock was sold to local people in 1900. It owns the London Telephone Company, of London, Ohio, and an interest in the Home Telephone Company, of Washington C. H., Ohio. Through the Franklin County Telephone Company it operates 14 exchanges. A bond issue of $650,000, bearing 5 per cent interest, is due in 1920. There is outstanding $676,800 of 6 per cent cumulative preferred stock and $750,000 common stock on which 1¾ per cent has been paid quarterly.

At a meeting on Nov. 17 at the Chittenden Hotel in Columbus, the sub-committee of five, appointed at a meeting of telephone men some time ago, made a report to the committee of fifteen, which was promptly adopted. This report recommends the merging of all the independent companies of the State into one corporation. It is proposed that the stock of the various companies shall be exchanged for the stock of the larger company on an appraised value, and that the bonds shall be exchanged for bonds given by the new organization. This report was formulated after receiving an opinion upon the matter from almost every independent company in the State, a letter of inquiry having been sent out some days previous to the meeting. It is the general belief that the organization of a company to take over all the small companies will be brought about at once as a matter of protection against any move that might injure the independent companies.

Opinions are prevalent throughout Ohio that the Postal Telegraph Company is the real interest back of the purchases that have been made, although there has been no statement made by any officers of that company, so far as known. It is alleged that this company is getting together all the telephone interests possible in order to compete with the Bell interests both in the telephone and telegraph field. If the independent telephone companies of the State could have full information on this matter, with assurances that their properties would be used to forward the independent movement and never be turned over to the Bell people, there might not be so much objection to its acquiring them.

It was announced the latter part of the week that Mr. F. R. Huntington had also made a proposition to purchase a controlling interest in the Dayton Home Telephone Company, Dayton, Ohio. For the preferred stock he offered $90 per share and for the common $20 per share. This company has not been as prosperous in the way of returns on investments as the Columbus company, so the offer was less favorable. It is thought, however, that the controlling interest will be secured by him. The terms and conditions were about the same as in the case of the Columbus company.

Some of the telephone men feel that the merging of all the small companies in the State into one large corporation will place the properties in position to be easily acquired by the same interests that are taking over the large companies. If this is a friendly interest, there will be no trouble, but if the whole list should finally go to the Bell, as is believed they will in some quarters, the intentions of the independent men for the past 10 or 15 years will have been shattered.

It has been announced that the properties of the Central Union Telephone Company and the Tiffin Home Telephone Company at Tiffin, Ohio, have been consolidated and taken over by the Tiffin Consolidated Telephone Company. It is said that the stock of the new company has been apportioned about equally between the independent telephone men and representatives of the Central Union. The officers are as follows: President Arthur A. Cunningham, Tiffin; vice-president, Louis Selle; secretary, A. J. Mellen, Toledo; treasurer, J. J. Fleck; Tiffin. This is rather a peculiar move to be made at this time and has not yet been explained by anyone.

Deep Waterways and Hydroelectric Power.

Mr. W. Clyde Jones, of Chicago, is not only a practising lawyer and the State Senator from one of the Chicago districts, but he is also a man who has been particularly interested in electrical pursuits, with which he is rather intimately connected. He is, therefore, no stranger to many of the members of the Electric Club of Chicago, whom he addressed on Nov. 17 on the subject of "The Deep Waterway." He is a good extemporaneous speaker, and he presented his subject forcibly and attractively. He said that the coming generation will be a generation of conservation; the last two generations since the Civil War have been generations of destruction. Now, however, the conscience of the country is aroused. Among other evidences of this tendency is the undoubted fact that the Government will curb the power exercised by the railroads and develop the waterways of the country. Through the deep-waterway conventions and by other means, the people have become deeply interested in this subject.

The railroads have conducted a systematic warfare against waterways for a long term of years, and water-borne commerce, particularly in the Mississippi Valley, has decayed during the last 40 years. But the railroads cannot take care of the increasing traffic of the country in good times, as is shown by the famine in freight cars. It is, therefore, necessary, merely on this ground, that the waterways should be developed. The Chicago Drainage Canal, costing $58,000,000, 30 miles long and 24 ft. deep, has been built by the people of Chicago to connect Lake Michigan with the Desplaines River at Lockport, Ill. This is at one end of the Lakes-to-the-Gulf waterway project, and it may be said that the Panama Canal now being built by the United States Government is at the other end. The speaker described the various deep-waterway proposals in the Mississippi Valley. The project of deepening the Illinois River and connecting it with Lake Michigan is only one of these. There are also projects for deepening and improving the Ohio River, the upper Mississippi and the Missouri River. Outside of the

Mississippi Valley there are also proposals to construct inner channels along the Atlantic, Gulf and Pacific coasts.

But the advantages to commerce are only one recommendation for these proposed deep waterways. River improvement means the controlling of floods, the prevention of the waste due to erosion of the soil and the reclamation of many millions of acres of submerged or partially surbmerged lands. Then, too, there is the possible water-power development. In Illinois it is proposed to build a deep river channel in the Desplaines and Illinois rivers from Lockport, the present terminus of the Drainage Canal, to Utica, which is the present head of navigation on the Illinois River. It is calculated that 140,000 hp can be developed at various points along this channel. It is proposed that the State build this canal at a cost of $20,000,000, and it is said that the revenue from the sale of water-power would net $2,500,000, or sufficient to pay interest on the bonds and establish a sinking fund. Senator Jones told of the work of the Sanitary District in building the present Drainage Canal, and of some conflict that has arisen between its present water-power development and its future plans in that direction and the water-power developments of private owners on the Desplaines River. The people of the State had voted in favor of a constitutional amendment to allow the issue of $20,000,000 worth of bonds to build the proposed deep waterway from Lockport to Utica. When the Legislature considered this question, the Senate was decidedly in favor of it, but the lower house voted in favor of waiting until the Federal Government could be induced to cooperate with the State by extending the deep waterway from Utica down the Illinois River to the Mississippi and improving the Mississippi so that there would be a continuous channel, perhaps 14 ft. deep, from Lake Michigan to the Gulf of Mexico. In the proposed deep waterway from Lockport to Utica, Ill., it is planned to extend the depth of the present Drainage Canal, 24 ft., as far as Joliet, and from there dig a 14-ft. channel to Utica. The Lockport-Utica channel would constitute a second link in the Lakes-to-the-Gulf waterway, making, with the first, already built, a channel with a minimum depth of 14 ft. and over 90 miles long.

The question now arises: What shall the people of Illinois do? Shall they wait for Federal assistance, or shall the State proceed to construct, at an expense of $20,000,000, the second link in the deep-waterway project? It has been estimated by Government engineers that it will cost $30,000,000 to deepen the Illinois and Desplaines rivers to the end of the Chicago Drainage Canal at Lockport. If that estimate is correct, and if the proposed Lockport-Utica link can be built for $20,000,000, it will only leave $10,000,000 to do the rest of the work from Utica to the mouth of the Illinois River. The trend of the speaker's remarks indicated that he was decidedly in favor of carrying out the expressed will of the voters by authorizing the constitutional amendment permitting the issuing of $20,000,000 in bonds for this purpose.

In answer to Mr. Harold Almert, Senator Jones explained the recent decision of the Illinois Supreme Court in which the complaint of the State against the Economy Light & Power Company for obstructing the Desplaines River at Dresden Heights was dismissed. This decision was summarized in a previous issue of the *Electrical World*. The speaker explained how the Desplaines River was not navigable before the Drainage Canal water was turned into it; after that time it became a very respectable stream. The Supreme Court has held that it is not a navigable stream, and that, therefore, the private owners at Dresden Heights owned the land to the middle of the river, and the State has no right to remove the obstruction of the private owners on the ground that the river is navigable. The decision means that the Dresden Heights property must be condemned and purchased at its fair value if the deep-waterway project is endorsed by the Legislature, following the approval of the constitutional amendment by the voters. Senator Jones' speech was clear and convincing, and was received with manifestations of approval.

It happened that there were several distinguished visitors at this meeting of the club, and President Vose alluded to the presence of Dr. E. J. Berg, the new professor of electrical engineering at the University of Illinois, before he introduced the next speaker, who was Dr. Charles P. Steinmetz, of Schenectady. Dr. Steinmetz, who was received with great applause, said that the citizens of the United States are deeply interested in seeing the waterways of the country restored to their former importance. Engineers are also interested in the subject, both as citizens and as specialists. "For instance, as engineers," said the speaker, "we are all interested in seeing every drop of the water of Niagara going through turbines rather than pouring over the cliff as a cataract; as citizens, however, we may not desire to go as far as this." He spoke of the preservation of the waterways, the forests, the watersheds and the coal supply as being all interlinked; each feature of the program is intimately connected with the others. "When we survey a large hydroelectric plant, with its big power house, its long transmission line and its extensive hydraulic works, and observe that in summer the water is so low that coal, itself not inexhaustible, must be used to supplement the diminished water-power, we must realize the importance of equalizing the flow of water throughout the whole year. Furthermore, the improvement of waterways will prevent the erosion of soil, which is an important consideration. From various points of view, it is time to look to the preservation of natural resources. We may disagree, perhaps," said Dr. Steinmetz, "on the question of how far the Government should go in utilizing and protecting water-powers without injuring legitimate private interests. Nevertheless, as citizens, we all must agree in conceding the gravity and importance of the problems presented."

Mr. B. J. Arnold, who was present, was called upon, but as he is to address the club soon, he excused himself from making any extended remarks.

Grounded Secondaries.

Mr. W. J. Canada presented a paper on Nov. 12 before the Denver N. E. L. A. branch in which the subject of grounded secondaries was thoroughly treated. After giving a résumé of the objections of both underwriters and lighting companies to grounding, it is stated that all of these have practically been done away with. In the first place, the normal ungrounded secondary suffers so chronically from the accidental ground at one point or another that the condition of a normal ungrounded secondary may be considered very uncertain and this opinion is concurred in by two-thirds of the lighting companies whose opinions have been obtained on the subject. Therefore, the theoretical advantage of the ungrounded secondary over the grounded—that of minimizing short-circuit arcs due to grounds into buildings—may be stated to be to a large extent fictitious.

In the second place, the breakdowns which occur with alarming frequency all over the country when primary voltage enters on secondary wiring in buildings were either not anticipated by the underwriters in making their objections, or the frequency and severity of these troubles in the causing of fires and consequent losses to insurance companies were not sufficiently reckoned with. At present the underwriters' interests are very generally of the opinion that grounding secondaries actually reduces the fire hazard and their objection from being a very active one has passed through the stages of being passive and then complacent, and they are now the whole country over becoming favorable to grounding. While the underwriters have thus far objected to the requirement for grounding being made mandatory in the National Electrical Code of which they are the principal sponsors, this is simply for the reason that in their utilization of the "Code" as a standard for fire hazard they cannot, without definite information that fire hazard has increased by the non-grounding, enforce a grounding which is popularly presumed to be a purely life measure.

The objection on the part of lighting companies to grounding, that the grounding is of considerable initial expense, increases maintenance troubles, injures the continuity of service, etc., is directly refuted by the action of the great majority of companies in grounding, mostly of their own volition; by their

written statements, in favor of grounding, many of which have been published from time to time throughout the country, and by the organized action of their national associations, such as the National Electric Light Association, the Association of the Edison Illuminating Companies, etc. Out of some 40 companies written to, 95 per cent reported that no noticeable increase in maintenance has been observed since the grounding of secondaries, that lightning troubles no longer exist, or are in many cases less frequent, than previous to grounding, and that minor troubles in consumers' premises are much more readily checked with the grounded system than with the ungrounded. All these companies give their unqualified approval of grounding and state that under no circumstances would they return to the use of an ungrounded system.

The question as to the limiting voltage of secondaries where grounding should be required is not so essential as might appear, although its discussion has delayed the definite recommendations of some of our engineering societies in this matter. Ninety per cent of all building wiring would be protected with the grounded secondary limited to secondaries of under 300 volts. The general tendency seems to be toward grounding secondaries of higher voltages as well, and then depending on insulation and covered contacts for part of the protection to life from these higher voltages in rooms with grounded surfaces. The decrease in probability of fire by the grounding of a 220-440-volt secondary would hardly be considered less than the decrease in this probability when a 110-220-volt circuit is grounded. Lighting companies at present can make no mistake by following the unanimous engineering opinion that circuits up to 150 volts should be grounded, and this will take care of 90 per cent of all circuits entering buildings.

The experience of lighting companies which have operated with both grounded and ungrounded secondaries develops the fact that the general maintenance costs are not increased with grounded secondaries, that fewer transformers are lost, and that troubles from high voltage in customers' premises are entirely eliminated, whether affecting life or property.

In the discussion of the paper no opposition developed to the grounding of secondaries at any voltage, and the point was brought up that the limitation to 150 volts when grounding would be in entire contradiction of European practice.

Steinmetz on Law of Conservation of Energy.

Dr. C. P. Steinmetz lectured on the "Law of the Conservation of Energy" before a joint meeting of the Chicago branch of the A. I. E. E. and the electrical section of the Western Society of Engineers at Chicago, Nov. 16. Dr. Steinmetz's lectures have come to be an annual event in Chicago and always serve to bring together the largest crowd of electrical men of the year in that city. Mr. W. L. Abbott introduced as chairman of the meeting Mr. Bion J. Arnold as the one most entitled to preside at the joint meeting, owing to his being an ex-president both of the American Institute of Electrical Engineers and the Western Society of Engineers. Before the speaker of the evening was introduced Mr. Ralph W. Pope, secretary of the A. I. E. E., was announced as another guest of honor of the evening and made a few remarks.

Dr. Steinmetz began his lecture by calling attention to the fact that the law of the conservation of energy and the law of conservation of matter have been known for many years. The aid they may give to engineering calculations has not always been appreciated. The law of conservation of energy teaches us that energy can never be destroyed. It can only be changed in form. When a revolving balance wheel is gradually brought to rest by friction the mechanical energy stored in it is transformed into heat. We speak of the energy being lost because it is changed into a form in which it is of no practical use because the heat is so much dissipated or "spread out so thin" that it cannot be utilized. The units of electrical energy can be transformed into the equivalents of mechanical and heat energy. If the c.g.s. system of units is used the calculation is simple. If the ordinary commercial units are used the calculation of one into terms of the other is more cumbersome.

The law of conservation of energy can be used to simplify greatly calculations by taking the input to a machine and the output, or by taking the losses and the input to get the output. For example, in calculation of dynamo or motor losses we measure any two of the three factors, input, output and losses, to obtain the third factor. This is much simpler than trying to calculate in detail the various losses in different parts of the dynamo structure. One might calculate such losses if he had sufficient information as to the structure of the machine and the losses taking place in various parts and, as Dr. Steinmetz puts it, "if he lives long enough to do it." The law of conservation of energy, however, gives us the short cut. Likewise, magnetic pull, losses in transformers, and energy dissipated upon the interruption of a circuit can be calculated on similar principles, thus doing away with inconvenient and cumbersome calculations.

Meeting of Ohio Society of Mechanical, Electrical and Steam Engineers.

The twentieth meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers was held in Lima on Nov. 19 and 20. The address of welcome was delivered by Dr. Bowser, president of the City Council, and was responded to by Mr. F. W. Ballard, president of the society.

In his presidential address on "Power Costs for Factories," Mr. Ballard discussed the utilization of exhaust steam for heating buildings, which he estimated to be worth 2 cents per month per square foot of radiating surface for six months in the year, and outlined the advantages arising from keeping accurate detailed records of the costs of operating machines in a factory. He stated that the steam consumption of steam pumps is often at least five times that required by large central engines driving generators for supplying energy to motors for doing the same work, and in extreme cases with long lines of steam pipe and intermittent service the steam consumption has been found to be 10 times what would have been required by central units for the same service. The speaker claimed that the first requisite of low-service cost is a system of accounting and follow-up records. The individual motor drive was advocated only in cases where one machine, taking a large proportion of the power necessary to drive a group of machines, is used intermittently, and the motor driving the entire group evidently would operate at only a fraction of the rated load for the larger portion of the time.

In the discussion Messrs. O. F. Rabbe and Grant Miller and Prof. W. T. Magruder claimed that the charge of 2 cents per square foot for steam heating was too low. Mr. Miller stated that from 30 cents to 35 cents would be more nearly correct.

Professor Magruder reported the results of an investigation which showed that the cost of operating a certain boiler plant for steam heating alone, in the winter time, was nearly equal to the cost of running the plant for both the motor service and the heating service combined. In speaking of group drives, Professor Magruder cited a case where 800 hp was required to run the shafting during the noon hour while only 1000 hp was needed to operate the shop during working hours. With mechanical transmission the losses may be from 40 to 50 per cent, while with electrical transmission the losses may be reduced to 15 per cent.

Mr. David Gaehr remarked that the value of the losses in shafting and belts is often greatly exaggerated. Even when test results indicate excessive losses, they may be attributed to poor design, inadequate bearing surfaces, insufficient contact between belts and pulleys and poor alignment of shafting. Attention was called to the "balancing" of drives by which as many belts are on one side of the shaft as on the other, in which case the pressure produced by the pull of the belts on the hangers will be balanced, or nearly so.

Mr. Ballard said that a fair estimate of the loss in shafting, etc., is from 30 to 35 per cent of the total load.

A paper by Prof. E. A. Hitchcock, descriptive of the new laboratory of the department of mechanical engineering at the Ohio State University, on account of the absence of the author, was presented in abstract by Professor Magruder. The building is of modern factory construction with saw-tooth roof. The paper contained outlines of the testing apparatus with which the laboratory is equipped.

A paper on the Darling oil gas producer was read by Mr. A. B. Davis, a paper on turbine pumps by Mr. Wetmore H. Titus, and one on coal-handling and ash-handling equipments by Mr. David Gaehr. Mr. Gaehr gave data showing that the cost of handling coal and returning ashes by manual labor varies from 18 to 55 cents per ton, while the cost for the same service performed by machinery varies from 1 cent to 10 cents per ton. Particular emphasis was placed on the electrically driven monorail crane which possesses many advantageous features in the handling of coal and ashes.

The members were afforded opportunities to visit the oil manufacturing plant of the Solar Refining Company, the Lime Locomotive Works and the cigar factories at Lima.

Officers for the next year are as follows: President, Mr. O. F. Rabbe; vice-president, Mr. Grant Miller; managers, Messrs. Ira Cole, C. Thomas Baker and E. E. Adams; secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. The next meeting will be held in Cincinnati on a date not yet determined.

Electric Propulsion of Naval Vessels.

Two applications of electricity to propulsion of naval vessels were described in a paper presented by Mr. W. L. R. Emmet at a meeting of the Society of Naval Architects and Marine Engineers held in New York on Nov. 17 and 18. The applications were designated as the "combination drive" and the "electric drive" respectively. In the former, use is made of both electric motors and low-pressure steam turbines for driving the propeller shafts, while in the latter the propulsion is wholly by electric motors. The first of these plans has been made the subject of a proposition to the Government for one of the new battleships, the turbine part being designed by the Fore River Shipbuilding Company and the electrical part by the General Electric Company. The second plan has been applied on a small scale to two fireboats in Chicago, and is being elaborated for application to war vessels.

In the combination drive it is proposed to use twin screws and to mount upon each propeller shaft a low-pressure turbine and an electric motor. The motor would receive energy from a generator driven by a high-pressure turbine which would exhaust through the low-pressure turbine. The adjustments would be so made that at full speed the motor would deliver two-fifths and the low-pressure turbine three-fifths of the power taken by the propeller shafts. At low speeds the low-pressure turbine would carry no load. The motors would be of the two-speed squirrel-cage induction type without provision for reversal; the low-pressure turbine would be fitted with two reversing stages similar to those that would be adopted with direct turbine drive.

In the complete electric drive, as applied specifically to naval vessels, it is proposed to mount on each propeller shaft two motors, one of which would be arranged with pole-changing switches so as to adapt it to use at lower speeds, this motor being similar in construction and performance to that proposed with the combination drive. The other motor would have only a small number of poles for use at high speeds, but would be of the wound-rotor type adapted to producing the high torque desirable in rapid changes of the ship's direction.

The author stated that the electric speed change involves no kind of complication, difficulty or uncertainty. The efficiency of the electric speed-reducing arrangement was said to be 92 per cent, which is higher than any other arrangement that can be used for the same service.

The results of calculations are given showing that with the electric drive there would be a reduction in the machinery weight from 520 tons for the steam turbine drive to 354 tons; a decrease in the steam consumption from 25.6 lb. to 17.8 lb. per hourly horse-power; and with the same boiler equipment, an increase in cruising range from 4700 to 7600 miles at 12-knot speed, or in maximum speed from 20.5 to 21.2 knots.

Meeting of the American Association of Electric Motor Manufacturers.

The semi-annual meeting of the American Association of Electric Motor Manufacturers was held at Planters Hotel, St. Louis, Mo., Nov. 15-18. The reports of committees on standard motor speeds, standard pulleys and standard motor dimensions were received, and the committees reappointed to complete their work. These committees are working in conjunction with committees from the National Machine Tool Builders' Association. The American Association of Electric Motor Manufacturers also has a committee working in conjunction with a committee from the National Electric Light Association, for the purpose of making a tabulation of motor data and applications, which will be published jointly in an edition on "Power." When this is published it will be the most reliable tabulation extant. The committee on standard motor speeds has been working assiduously for over a year, and, although much work has been accomplished, it was not possible to take definite and final action on this important subject.

On Nov. 16 a theater party attended the Century Theater, and on Nov. 17 the delegates visited the plants of the Century Electric Company, the Emerson Electric Manufacturing Company and the Wagner Electric Manufacturing Company, after which luncheon was served in the Glen Echo Country Club. In the afternoon golf and shooting tournaments were held, and a banquet was given at the Planters Hotel on the evening of Nov. 17.

The next meeting of the association will be held at Hot Springs, Va., in May, 1910, and the exact date will be chosen so as not to conflict with other conventions which will be held at that time. The officers of the association are: President, Mr. S. L. Nicholson, Pittsburgh; vice-presidents, Messrs. C. W. Holtzer, Brookline, Mass.; J. C. Hobart, Cincinnati, Ohio; J. W. Ham, Schenectady; the secretary-treasurer is Mr. W. H. Tapley, Engineering Societies Building, New York City.

Philadelphia Electrical Show.

The electrical show to be held in Philadelphia beginning Feb. 14, 1910, is the first exhibition of the kind given there, and its probable success is indicated by the fact that almost one-half of the available space has already been engaged. One of the features of the show will be the provision of special nights in the interest of various electrotechnical and commercial organizations, engineers, central-station men and other classes interested in electricity from a commercial or technical standpoint. Many novel features and exhibits are being planned, and arrangements for an exceptionally artistic scheme of decorations and illumination are being completed. One of the objects of the exhibition is to encourage the use of electric vehicles throughout this territory, and there will be a large showing of both commercial and pleasure cars.

Convention of the National District Heating Association.

The first annual convention of the National District Heating Association was held in Columbus, Ohio, on Nov. 10 and 11. The convention was called to order by the president of the association, Mr. A. C. Rogers, to whom is due the credit for its organization. Mr. Rogers took as the subject of his presidential address "The Objects of the Association, Past, Present

and Future." He stated that in Ohio there are about 50 district steam-heating companies that are in reality auxiliaries to electric lighting companies belonging to the Ohio Electric Light Association. A few of these companies formed the temporary organization which developed into the National District Heating Association. He said that there are about 500 district heating companies in the United States, the larger number of them being in the States of New York, Pennsylvania, Ohio, Indiana, Michigan and Illinois.

Mr. H. W. Hillman remarked that the association will be heartily supported by many electrical engineers and solicitors of electrical generating companies. He called attention to curve-drawing steam meters that are now being developed. These instruments will be of immense value to district steam-heating companies.

A paper entitled "The Venturi Meter and Its Use in Power Plants" was presented by Mr. C. G. Richardson. The author discussed the discovery by Venturi in 1797 of the sucking action of fluids in motion through a contracted section of pipe, and the application of this principle by Herschel in 1886. Various types of the Venturi meter were then described from the smallest up to one 17 ft. in diameter capable of measuring more than 1,000,000,000 gal. per day. He predicted that the Venturi meter will be recognized as the universal meter for indicating the velocity of anything that flows in pipes.

In reply to a question by Professor Knight, Mr. Richardson said that the evaporation of water into steam introduces a slight error when a Venturi meter is used with hot water.

In a paper by Professor Knight, entitled "Deterioration in Underground Heating Mains," much data were given relative to the exact deterioration of a certain heating system where use was made of steel pipe laid in wooden conduit and surrounded with oil-treated shavings. Examination made five years after the pipes had been installed indicated a yearly depreciation varying from 1.82 per cent for a 12-in. pipe to 4.70 per cent for a 1.5-in. pipe. The life of the conduits was placed at values ranging from 30 years for the 12-in. to 16 years for the 15-in. conduit.

Mr. Harding claimed that unless the velocity of water in the pipes is at least 3 ft. per second there will be a sediment from decayed vegetable matter that will corrode the bottom of the pipes. Deterioration depends to a great extent also on the character of soil in which the pipes are laid.

Mr. Gifford expressed the opinion that of all soils clay is the best in which to lay heating mains. Sand and cinders are disadvantageous probably by reason of this porosity. Oil-treated shavings offer excellent protection for iron pipes.

Mr. W. E. Taylor read a paper on "Thermostats and Thermostatic Action," in which the three standard systems of heat control were outlined. In one system use is made of a strip of brass and steel welded together, the curvature of the strip depending upon the temperature. In another system use is made of a liquid which evaporates and operates a valve by its expansion. In the third system advantage is taken of the expansion of air in a cylinder to move a piston connected to a valve. Mr. Taylor said that the saving in coal when automatic heat control is employed amounts to from 30 to 35 per cent of the coal used when the control is manual.

The subject of air leakage around windows was treated in a paper by Mr. Harold McGeorge. Test data were given to show that from 12 to 15 per cent can be saved by using weather strips around windows. Moreover, when strips are used, the calculations of the steam required for heating a building can be made with a high degree of accuracy.

Mr. A. C. Rogers expressed the belief that the leakage is essential for changing the air in a room in houses where no other provision has been made for ventilation.

Mr. H. W. Hillman stated that from his own experience he had found that when a house is provided with proper weather strips it can be heated with electricity at 1 cent per hp-hour at a price to compete with coal.

Mr. Sawhill cited a case where weather strips had made almost 50 per cent difference in the costs of heating two identical houses in the same locality.

In response to an invitation from the president, Secretary Gaskell, of the Ohio Electric Lighting Association, discussed the methods that should be employed for improving the interest in the National District Heating Association, and increasing the membership.

A paper entitled "Advantages to Electric Companies of Central-Station Steam Heating" was read by Mr. Kline, of the American District Steam Company, Lockport, N. Y. A paper on heating and ventilation was read by Mr. Woodward.

Mr. A. C. Rogers, Toledo, was re-elected president of the association. The secretary is Mr. William Wolls, Columbus, Ohio. The next convention will be held at Toledo, Ohio, in May, 1910.

Meeting of the Empire State Association.

The fifth annual meeting of the Empire State Gas and Electric Association was held at the United Engineering Societies Building, New York, on Nov. 17 and 18. The meeting was called to order at 2 p. m. on Nov. 17 by Mr. R. M. Searle, of Rochester, vice-president, who, in the absence of the president, Mr. William T. Morris and of Mr. M. J. Brayton, also a vice-president, presided at all of the sessions.

Reports of various officers and committees were presented at the opening session. Mr. C. H. B. Chapin, the secretary, reported an increase of six active and three associate members in the year. The report of the treasurer, Mr. T. O. Horton, who resigned on account of ill health, was read by Mr. Chapin. It showed that all dues for the year had been paid.

The report of the accounting committee was presented as a tentative report by Mr. E. C. Scobell, of Rochester, the chairman. It referred to the classifications of accounts adopted on Dec. 18, 1908, by the Public Service Commissions of both the First and Second Districts, for gas and electric corporations under their jurisdiction. While the companies of the State were divided into four classes according to their gross income, the committee endeavored to have the most condensed classification still further reduced for the smaller companies, but without success. The Public Service Commissions have, however, signified their willingness to give every aid in their power to the smaller companies in their difficulties.

Shortly after the orders of Dec. 18 were issued, inquiries began to be received at the office of the association, chiefly from the smaller companies, as to where they could obtain the forms necessary for use in keeping the classification prescribed. Investigation showed that a very large number of the smaller companies were in no way prepared to undertake any such elaborate scheme of accounting as that required, and, in fact, it was found that many of them are at the present time keeping merely a record of their receipts and disbursements, or, in other words, keeping their books according to single-entry method.

As the demand for forms continued, the accounting committee felt that it would be advisable in preparing the report for the annual meeting, to submit a simple set of forms, and also to explain not only the forms themselves, but the method in which they should be kept. It was also felt that a simple explanation of double-entry bookkeeping would be found of value to small companies. Such an explanation is incorporated in the report.

The committee held a large number of meetings, devised and discussed several different schemes, conferred with the Public Service Commission at Albany and finally adopted the plan of assigning to each member of the committee a subject or department of the business on which to prepare a paper that would meet with the approval of the committee as a whole. The committee has also recommended for use in general offices forms and methods of accounting that have been selected from various schemes suggested and discussed, and feels confident that the recommendations are thoroughly practical and can be followed by the majority of the smaller companies of the State to their ultimate great benefit.

The papers and forms recommended have been approved by the Public Service Commission. The statisticians of both commissions have received inquiries as to the interpretation of portions of the accounting order. Some of these questions, with the tentative answers given, are printed as an appendix to the report. The committee expressed its thanks to the commissions for permission to publish these questions and answers and its appreciation of the very courteous treatment it received from the commissions and their representatives, and also extended to Mr. Chapin, the secretary of the association, unqualified thanks and appreciation for his painstaking efforts in helping with this work.

The report is signed by Messrs. Scobell, the chairman; A. S. Cook, G. W. Curran, F. L. Dame and T. W. Summers.

At an ensuing session it was decided by the association to receive the tentative report of the committee and make it available for distribution. It is understood that copies of the report and the forms, which have been prepared full size, may be purchased at the office of the association. The report is divided into various sections, the first of which gives comments on the capital accounts prescribed by the commissions. Other subjects which are taken up are general office accounting and bookkeeping and commercial department, storeroom and job order accounting and payroll accounting.

A list of the forms as recommended follows: Form A, cash book; B, journal; C, general ledger; D, accounts payable voucher; E, check voucher; F, voucher record; G, expense and improvement ledger; H, transfer voucher; I, trial balance and summary sheet; J1 service order—gas; J2, service order—electric; K1, meter application—gas; K2, prepayment meter application—gas; K3, meter application—electric; L1, set and remove meter order—gas; L2, set and remove meter order—electric; M1, meter set report—gas; M2, meter set report—electric; N1, meter record—electric—book; N2, meter record—electric—card; N3, meter record—gas; O, meter set and removed report—gas and electric; P, meter reading sheets—gas and electric; Q1, consumers' ledger—bound, gas; Q2, consumers' ledger—bound, electric; R1, consumers' ledger—loose-leaf, gas; R2, consumers' ledger—loose-leaf, electric; S1, bill forms—gas; S2 bill forms—gas; S3, bill forms—electric; T, sales order and storeroom requisition—gas and electric; U, merchandise sales book; V, miscellaneous accounts receivable ledger; W, storeroom requisition; X, stock sheet; Y, job cost sheet; Y1, cost sheet and storeroom requisition; Z, daily time slip; Z1, payroll books.

Mr. Searle made a verbal report as chairman of the committee on sectional arrangements. The plan is to have three or four sectional meetings annually in the State. It is believed that by careful selection of the localities for the meetings many small companies that cannot afford to send representatives to New York City will be reached. The idea is to have an informal discussion of one subject at each meeting of this character. The committee will plan to hold the meetings during the coming year.

The report of the committee on insurance was devoted to liability insurance. It was presented by Mr. R. A. Davidson, the chairman, and recommended that if a number of companies would act together they could secure lower rates.

Mr. T. R. Beal, of Poughkeepsie, presented, as chairman of the committee on taxation, a report giving a digest of new laws on this subject passed at the last session of the Legislature and a number of decisions rendered by the courts during the last year.

At the electrical session which followed Mr. P. T. Glidden, vice-president and general manager, Binghamton Light, Heat & Power Company, read a paper on "An Electrical Show in a Community of 45,000." Mr. Glidden described a show which followed the decision last spring that some plan other than newspaper advertising must be devised to enlighten and instruct the general public as to the various uses of electricity in the home. The co-operation of the leading firms of decorators, furniture dealers, plumbers, furnishers, fixture dealers, etc., was invited and each of these bore part of the expense. A large hall on the ninth floor of an office building was rented and a model eight-room apartment built. In addition to this, in two rooms connecting with the hall, there were a demonstration booth and a showroom. In the booth two expert demonstrators showed practical cooking by electricity.

In the showroom all kinds of current-consuming devices that could be used in the home were exhibited. The show was planned to remain two weeks. The attendance increased daily to such an extent that at the end of that time it was decided to continue for two weeks more with a complete change in decorations and electrical effects. In the four weeks very close to 25,000 people attended the show. The firm that made the exhibit of furniture sold $2,000 worth at the exhibition and the decorators did even better than this. The cost of the show to the company was about $900 and it could be produced again for about one-half this amount. A permanent show of this nature has been installed in a town of about 8000 with the assistance of the local merchants.

An abstract of the paper by Mr. C. G. Durfee, chief of the meter department, Rochester Railway & Light Company, on "Electric Meter Testing," will be given in a later issue.

The paper of Mr. C. H. B. Chapin, on "Electric Light and Power Development in New York State," was next on the program. From September, 1907, to April, 1909, according to the *McGraw Electrical Directory*, the number of central-station companies in New York State increased from 318 to 358, and investigation showed that almost all of the new properties operated in communities of from 1000 to 5000 population. Of the total number of companies 275 supplied either single communities or groups of communities having less than 5000 population. About 200 of the companies supplied communities of less than 2000 inhabitants. The report of the Public Service Commission for the year ended June 30, 1907, indicated that a large number of the small companies showed a deficit each year. The real reason for the increase in the number of plants, notwithstanding the financial results indicated, seemed to be ignorance of the results of other undertakings of a similar character combined with pressure from the residents of the community or from a promoter who was looking out for merely his own interests. The reports required by the Public Service Commission may be of value in giving greater publicity to the facts and thus preventing the increase in the number of small companies, which, by their failure to become successful commercial enterprises, had kept the industry from attaining the standing it should properly have with the investing public. At the same time, the demand for service must be met and if the number of small plants was not to be increased some other means must be suggested to meet the situation. The solution of the question seemed to be the combination of a large number of small properties into one and the supply of service to all of the communities from some central point at which a large generating station can be located. There should also be a willingness on the part of the large combined properties to extend into new territory and thus meet the increasing demand for service. The entire State of New York could easily be covered by 20 to 25 plants having a distributing radius of 50 miles each. While it would not be possible to cover the territory under existing conditions as economically as if no companies were operating at the present time, the figures gave some idea, Mr. Chapin said, of the enormous economic waste which the large number of properties now operating must necessarily entail. It was difficult for the managers of large or even moderate-size companies to appreciate the difficulties attending the operation of properties in communities of 5000 or less. Many letters had been received from small companies in reference to accounting subjects, and some of these gave statistics to show that it was impossible to employ expert accountants or even to expend any considerable amount of money on books and forms.

The morning session on Nov. 18 was devoted to the gas section. At a luncheon at the Engineers Club, which followed this session, 48 were present.

At the concluding session in the afternoon the election of

officers resulted as follows: President, Mr. Charles R. Huntley, president Buffalo General Electric Company; vice-presidents, Mr. M. J. Brayton, secretary Utica Gas & Electric Company, and Mr. R. M. Searle, vice-president Rochester Railway & Light Company; treasurer, Mr. G. W. Curran, comptroller, Syracuse Lighting Company; secretary, Mr. C. H. B. Chapin. Mr. L. C. Purdy, Orange County Lighting Company, was elected a member of the executive committee to fill the unexpired term of Mr. T. O. Horton. A telegram expressing the regret of the association at the ill-health of Mr. Horton was sent to him.

Convention of Alabama Light and Traction Association.

The second annual convention of the Alabama Light and Traction Association was held in Birmingham on Nov. 15 and 16. On the afternoon of Monday, Nov. 15, a paper was presented by Mr. C. C. Henderson entitled "Some of the Worries and Duties of a Central-Station Manager in a Small Town" and one by Mr. C. D. Armstrong entitled "Public Service Possibilities."

On Tuesday morning a paper, the object of which was to instruct the teacher, having the title "School for the Manager," was read by Mr. T. K. Jackson. "A Visible Side of Accounting" was the title of a paper by Mr. G. S. Emery. In the afternoon Mr. C. M. Cory discussed the corporation tax law and Prof. E. E. F. Creighton delivered a lecture on lightning arresters.

The entertainment features included a theater party on Monday evening, followed by visits to electric lighting plants; a luncheon at the Southern Club on Tuesday given by the officers of the Birmingham Railway, Light & Power Company.

The following officers were elected for one year: President, Mr. J. Howard Wilson; vice-president, Mr. R. L. Rand; secretary-treasurer, Mr. Lloyd Lyon, of Mobile; directors, Messrs. L. J. Davis, R. J. Chambers, A. H. Ford, R. L. Ellis and A. M. Cranford. The next meeting will be held at Anniston.

The Boston Electric Show.

The first annual electrical show to be held in Boston was opened to the public in Mechanics Building, Huntington Avenue, on Monday evening, Nov. 15, to continue until Nov. 25.

FIG. 1.—ONE OF SIX FLOATS RUN OVER BOSTON ELEVATED RAILROAD SYSTEM.

The show, which is the first of its kind ever held in the New England States, is fostered by the leading electrical interests of Boston with the object of exhibiting to the public the latest applications of interest to consumers stimulating the rapidly growing demand for electrical service of all kinds. Manufacturers and public-service corporations have combined their efforts to produce an exhibition of high quality rather than one of mere magnitude, and the artistic character of the decorations and illumination and the representative nature of the apparatus displayed render the show second in interest to none that has been given in the country in recent years.

FIG. 2.—ENTRANCE TO EDISON COMPANY'S BOOTH.

The decorations of the exhibit hall combine to produce a form and color scheme of much beauty. The entire show has been laid out in the form of an Italian garden dotted with natural and artificial flowers and foliage interspersed with white columns and balustrades, which form the exhibition spaces. Pillars of staff surmounted by clusters of translucent lighting bulbs serve to mark the aisles, and festoons of tungsten and carbon incandescent lamps with various prismatic shades furnish local lighting of the booths. Potted plants and flowers soften the harder outlines of the balustrades, and the exhibit floors are covered with grass matting to harmonize with the staff structures. The roof of the hall is concealed by three sweeping folds of light-blue cheesecloth extending from side to side, and the woodwork of the balconies is covered with red-striped awning interspersed with potted greenery. The general lighting of the hall is effected by 10 chandeliers equipped with clear and translucent-bulb lamps in green and white, and by 20 festoons of frosted incandescent lamps carried across the arena in arches between the chandeliers. There are also two rows of frosted incandescent lamps carried longitudinally along the balconies above the main floor and at the rear of the seats.

The entire stage and an extension into the main hall are occupied by the Edison Electric Illuminating Company of Boston, and the company's exhibit is the central feature of the show. A beautiful replica of an Italian garden has been constructed according to the plans of Architect Campbell, of the Atlantic Decorating Company, of Boston. The woodwork of the garden is in pure white, while overhead is a characteristic trellis draped with artificial verdure and tinted incandescent lamps, with clusters in the form of bunches of grapes and festoons of colored bulbs hung in chains from post to post. At the rear a temporary switchboard has been installed to permit flooding the garden with soft shades of light representing gradations from dawn to moonlight. The front of the garden is built in the form of a terrace with a trellised summer house at each side and a passageway bordered with potted plants and small nested incandescent lamps inserted in the interstices of the foliage. The two outer summer houses are specially set apart for visi-

tors of the company residing in Boston proper, and the balance of the garden, with colored electric fountains in the center, is devoted to reception tables for the company's customers and friends in the rest of the 33 municipalities which make up its present territory of over 500 sq. miles. The visitor from each town is welcomed by a young woman from his municipality dressed in Italian costume, and registration facilities are provided at each table. The municipality having the largest number of registrations per day receives each day from the company a substantial sum of money for charity. In the afternoon tea electrically steeped is served by the young women to all visitors, and there are daily concerts on the garden floor by a troupe of Italian singers and instrumentalists engaged by the company for the show. At these concerts moonlight effects and other attractive spectacular features are introduced. Each adult visitor on registering is given a handsomely prepared and illustrated booklet describing his home city or town, the series forming a most valuable library descriptive of suburban Boston. A printed technical description of the present Edison system is also available. At the rear of the garden the company has established quarters for its officials in attendance upon the show, with telephone service and writing facilities. Over the main entrance to the garden, which is reached by a short flight of stairs, the words "Edison Light" are emblazoned in incandescent letters. The company is also distributing badges for encouraging the growth of its territory, and practically the entire sales department is in attendance, either in the afternoon or evening of each day. A bulletin board placed on the side of the garden shows the number of visitors registered each day, the amount of new business secured by the company daily, and the special days and nights assigned to the different towns and departments. In the company's office at the show flag and sign decorations are in evidence with photographs of the L Street station, maps showing the growth of the underground and general system in recent years, special desk and general office lighting.

A complete list of the exhibits is given on another page.

Proposed Change in Baltimore Electrical Regulation.

A subcommittee of the Charter Commission, recently appointed in Baltimore, Md., has recommended the abolition of the City Electrical Commission. This is in line with other recommendations which the committee will make with a view that all of the engineering departments of the city shall be placed under the direction of the Board of Estimates. The suggested creation of a public service commission for Baltimore has thus far not received much support from the public, and the object of the Charter Commission is thought to be to invest some board that has already been created with the same authority that the Utilities Commission is clothed with in other cities.

Massachusetts Commission News.

The Massachusetts Gas and Electric Light Commission has issued a decision modifying the method of imposing a minimum monthly charge per meter, as petitioned by various customers of the Edison Electric Illuminating Company of Boston. The board says in part:

"The company has made a minimum charge of $1 per month per meter to all customers who have not signed a yearly lighting agreement. The petitioners were disposed to concede that some minimum charge was not unreasonable, but they claimed that it should approximate as nearly as possible the actual expense of maintaining a meter upon a customer's premises, and that the charge in question is excessive and should be greatly reduced or abolished.

"Wherever a meter rent or a service charge is imposed it appears to be as much for the express purpose of raising a definite revenue as the price per kw-hour for electricity consumed. On the other hand, the facts show that as a revenue producer, the minimum monthly charge is almost a negligible factor. In the fiscal year 1908 the receipts of the company from these minimum charges were about $20,000 as compared with a total revenue of over $4,000,000. In October, 1908, 4572 customers paid the minimum charge, of whom 576 used no energy and the others consumed in all 18,208 kw-hours, or an average of 4.36 kw hours per customer.

"From the experience of its department heads and computations from its books the company contended that the annual expense of maintaining a meter for a customer paying a minimum monthly charge was as follows:

Interest and depreciation	$2.79
Testing and repairs	.77
Reading	.42
Depreciation and loss of lamps per meter	.32
Accounting and billing per customer	2.44
Postage	.36
Stationery	.15
	$7.25

"To this the company added a charge for about 40 kw-hours consumed in every meter installed, independently of whether or not energy is used by the customer. As a matter of fact, however, the charge of $1 was first imposed by the company several years ago, and was then fixed arbitrarily and with little or no attempt to base it upon the expense actually incurred.

"The contention of the company, that whatever may be said as to the matter of expense, the real and important purpose of this charge is to prevent the accumulation of dead investment, is, however, entitled to serious consideration. There can be little question that it has this effect. Such a charge tends to discourage those who expect to be only slight users of electricity from seeking a connection with the company's lines and to induce those who, being so connected are not actual users, to discontinue the service. At the same time the company is bound to supply even small and occasional users of electricity and must not be permitted to evade this duty by imposing a minimum charge unreasonable and prohibitive in amount.

"On examination of the petitioners' accounts it was found that out of 16 who were customers during the whole of the year ending June 30, 1909, only five had used less than $12 worth of electricity at the established price of 12 cents per kw-hour. While there is no legislation with respect to a charge of this character for a supply of electricity, it is provided with respect to gas (Revised Laws, Ch. 58, Sec. 12) that 'no charge for the use of a meter during any portion of 12 consecutive months shall be made if the consumer during said time uses gas to the value of $7.' This provision seems to indicate clearly the legislative approval of a reasonable minimum charge for a public-lighting company's service. It has been in force for more than 20 years with no serious demand for its revision or repeal by either the public or the companies. The reasons for permitting such a charge in the case of gas companies have even greater force in the field of electricity supply.

"For these reasons the board recommends that, if the company shall continue to impose a minimum monthly charge upon its customers who pay the prevailing maximum net price, such charge shall not exceed $1 per month per meter; and that, if on any thirtieth day of June it shall appear that a customer has, by reason of said charge, paid or become liable to pay during the year immediately preceding an amount exceeding the minimum monthly charge multiplied by the number of months in which he has been a customer and an average price for electricity supplied by meter exceeding the prevailing maximum net price per kw-hour, the company shall refund all such excess; provided, however, that nothing in this recommendation shall be construed to require the company to render its service at an average charge per month less than the minimum monthly charge or at an average price per kw-hour less than the prevailing maximum net rate. The board further recommends that, whenever any person entitled to the refunding above described shall cease to be a customer of the company, such refunding shall be made imemdiately instead of upon the thirtieth day of June following."

Canadian Hydroelectric Commission News.

A conference was held in Toronto, on Nov. 15, of the accountants of the different Ontario municipalities who have agreed to take electric power from the Hydroelectric Commission. The meeting was held with a view to determine a standard system of accounting to be followed, and a committee was appointed to prepare the system using the form of report adopted by the Ontario Railway & Municipal Board as a basis. When the report of the committee is prepared it will be submitted to the different municipalities interested. The meeting was presided over by Mr. W. S. Andrews, who is engaged on a similar accounting work for the Hydroelectric Commission.

Counsel for the town of Port Arthur has served notice of appeal from the decision of Justice Clute granting the injunction restraining the town from entering into a contract with the Hydroelectric Commission for power. Meantime the power company has asked the Council to take into consideration an offer for delivery of power by his company, and a public meeting has been called for discussion. The Council, however, is preparing a new by-law for submission to the people for the adoption of hydroelectric power in case the injunction against the town is sustained by the Court of Appeals, and it is intended to invite Hon. Adam Beck, chairman of the commission, to speak at Port Arthur should the question be again put to a vote of the people.

A meeting was held in Toronto on Nov. 17 of the engineers of the various municipalities who are to take power from the commission. The system proposed to be adopted in Toronto for rates for domestic lighting did not meet with approval, and the members present decided to recommend that instead of charging for each room and also so much per kw-hour, the rate be based on the floor space of the house with an additional charge of a certain sum per kw-hour. It was pointed out that a large house might have fewer rooms than a small house, and thus the rich man would have an advantage over the poor. It is likely the Toronto electrical department will reconsider its proposed residential charges, as it is intended that the same system of charging shall apply to all the municipalities using cheap power, although the charges will vary according to local demand and consumption.

The meeting also reported in favor of the adoption of a luminous arc lamp in the business districts and the tungsten incandescent lamp in the streets of the residential districts. The lamps in the residential districts should, it was decided, be placed from 125 ft. to 150 ft. apart, so as to avoid any interference from trees.

An action was begun in the non-jury court, on Nov. 16, by Walter D. Beardmore, asking that the act giving the city of Toronto power to sell and distribute electric energy be declared *ultra vires*, and that the contract be declared illegal, since it is inconsistent with the by-law of last January naming $18.10 per horse-power per annum as a maximum figure. Mr. Beardmore asks an injunction restraining the city from entering into the business of distributing electric power. During the hearing of argument by counsel it was brought out that the city had already spent in cash and contracts executed for plant and equipment a sum of $313,000. Judgment was reserved by Chancellor Boyd.

On Nov. 17 a deputation, consisting of the Mayor and several aldermen from the city of Hamilton, waited on the commission to endeavor to obtain some further concessions for the city prior to Hamilton entering into a contract for cheap power. Hamilton wants the contract amended so that while taking 1000 hp from the Hydroelectric Commission they may be at liberty to take any further supply from the Cataract Power Company, thus giving that city the benefit of competition between the company and the commission while all the other 12 municipalities have agreed to take power exclusively from the commission.

The decision of the Hydroelectric Commission was contained in a letter from Hon. Adam Beck, chairman, to the Mayor of Hamilton, stating that the commission would not grant any better terms to Hamilton than those accorded to the other municipalities which have banded together to take cheap power, other than the possibility of extending beyond Dec. 31, 1910, the time when the city may decide to go in with the other municipalities and take power exclusively from the commission. The chairman in his letter states that while Hamilton is in a different position from the other places on account of its present contract with the Cataract company for street lighting at a low figure, he maintains that this advantage was secured to the city directly through the action of the other municipalities in joining together and applying to the Hydroelectric Commission for a supply of power.

New York Public Service Commission News.

The preparations for subway building in New York City are progressing rapidly toward a point where something tangible is about to be accomplished. The Public Service Commission sent to the Board of Estimate and Apportionment last week a requisition for $13,039,381, the amount of money needed to complete the contracts already let for work in Brooklyn, the board having only appropriated $2,850,000 at its former adoption of the contracts. At the same time the commission wrote a letter in which it expressed the opinion that it was inexpedient to appoint condemnation commissioners at this time for the Fourth Avenue route, because a suit known as the Joralemon case, fixing the status of the city with regard to the streets of Brooklyn, has not yet been decided by the Court of Appeals. Preliminaries for the actual work are actively under way and engineers of the commission are busy laying out the route of the tube.

The Public Service Commission is said to be maturing plans for the extension of the present Brooklyn subway from Flatbush Avenue and Fourth Avenue down to Sheepshead Bay. It is proposed that a major portion of this route will be on an elevated structure and it will traverse a section now poorly supplied with transportation facilities.

During the past year the Public Service Commission has received many complaints in regard to the insufficient lighting of trains on the Interborough-Rapid Transit, especially in the subway. It is claimed that only 10-cp lamps are used in the subway. The commission has ordered a hearing on the subject for Nov. 29, at which time the whole question of train lighting will be taken up.

Theodore P. Shonts, president of the Interborough Company, has had several conferences with Chairman Willcox, of the Public Service Commission, concerning the subway situation and it is now understood that the Interborough will be ready to bid on any future building of rapid transit lines in Manhattan or the Bronx.

The South Shore Traction Company has paid to the city $70,000 and obtained its franchise to operate cars from the Queensboro Bridge to Jamaica, a distance of about 18 miles. The company is now running cars across the bridge. When its line is completed it promises to carry passengers from Jamaica to the Manhattan side of the bridge for 5 cents. This is the rate that the New York & Queens County Railroad charges.

At the hearing on the question of heating cars, before Commissioner Eustis, of the First District, on Nov. 16, E. C. Connette, traction engineer of the commission, testified that since the previous hearing he had made tests to show the difference in the heating apparatus required in wooden and in metal cars. He estimated that metal cars would need about 23 per cent greater capacity to secure the same amount of heat. He also said that his investigations showed the majority of cars were equipped now with only about one-half the necessary capacity of heaters. When it came to discussing the definite question of temperature it was practically agreed that a minimum of 45 deg. Fahr. should be maintained when the outside temperature was 15 deg. or more above zero and 40 deg. when the outside temperature was less. No order has as yet been issued by the commission to this effect, but the representatives of the

traction companies were assured that sufficient time would be given the companies to equip their cars with additional heaters. The hearing on the subject was closed.

The Public Service Commission of the Second District has given its permission and approval to the Buffalo, Lockport & Rochester Railway Company to exercise the franchises granted it by the village of Middleport, Niagara County, on Oct. 25, 1909. The approval is upon the condition that prior to the construction of its transmission line pursuant to the terms of the franchise the railway company shall submit to the commission plans and specifications for such construction, and that no construction be made until such plans and specifications are approved. The commission has also approved of the contract between the Niagara, Lockport & Ontario Power Company and the Buffalo, Lockport & Rochester Railway Company leasing and granting to the Niagara, Lockport & Ontario Power Company the right and privilege of using the excess capacity of the transmission line of the Buffalo, Lockport & Rochester Railway Company for the purpose of transmitting and selling power to persons, corporations and firms other than the railway company in the locality traversed by said transmission line.

The Northern Westchester Lighting Company, of Ossining, has been authorized to issue $124,000 5 per cent gold bonds maturing June 1, 1950. The bonds are to be sold at not less than 90 per cent of their par value. The capital to be secured by the sale of the bonds is to be used to discharge indebtedness of the company incurred in making certain additions and betterments to its plant and distributing system.

CURRENT NEWS AND NOTES.

ELECTRIC LAMPS IN GASOLINE GARAGES.—The city of Denver has adopted an ordinance requiring all electric lamps installed in gasoline garages to be enclosed in vapor-proof globes.

N. E. L. A. COMPANY SECTIONS.—The organization of N. E. L. A. Sections at Buffalo and Toronto has been completed. The president of the former is Mr. Roscoe McMillan, and of the latter Mr. J. J. Wright.

SAN FRANCISCO ELECTRICAL SHOW.—An electrical exhibition will be held from Jan. 29 to Feb. 5 in the Coliseum, San Francisco. Of a total floor space of 40,000 sq. ft., 26,000 have already been engaged. Mr. E. M. Scribner is chairman of the committee in charge.

ROTARY CONDENSERS.—In our issue for Nov. 4 in an article entitled "Effect of Rotary Condensers on Power Factor," it was incorrectly stated that the average demand on the substations of the National Acme Manufacturing Company was 300 kw, the average demand being, in fact, about 500 kw.

MEETING OF THE A. I. E. E.—The next meeting of the American Institute of Electrical Engineers will be held Dec. 16, on the third Thursday instead of the second Friday of the month. A paper, entitled "Comments on Development and Operation of Hydroelectric Plants," will be presented by Mr. Henry L. Doherty.

NEW CHICAGO SUBURBAN ELECTRIC RAILWAY.—Mr. Eugene Purtelle, president of the Chicago Heights & Eastern Electric Railroad Company, has applied to the Board of Commissioners of Cook County, Ill., for a franchise for an electric railway from Chicago Heights east to the Indiana-Illinois State line, the route to be adjacent to the Elgin, Joliet & Eastern steam railroad.

N. E. L. A. SECTION MEMBERSHIP.—The November Bulletin of the Brooklyn Edison Section of the National Electric Light Association contains the following analysis of the membership of the section, which numbers 289: electrical construction, 56; operation, 49; distribution, 45; inspection, 37; sales, 25; purchasing, 22; fiscal, 22; engineering, 11; engineers of distribution, 9; auditing, 5; advertising, 2; executive, 2; general superintendent, 1; general, 1.

COLUMBIA ENGINEERING LECTURES.—Mr. Robert T. Lozier gave a lecture before the Electrical Engineering Society of Columbia University on Friday evening, Nov. 19, on the "Commercial Phases of Engineering." On Dec. 10 Mr. J. W. Lieb, Jr., associate general manager of the New York Edison Company, will lecture to the Electrical Engineering Society on the subject of "Electric Lighting." All the alumni of Columbia University, as well as others, are invited to be present. The lecture will be held in the Engineering Building, Columbia University, at 8:15 p. m.

BALTIMORE A. I. E. E. SECTION.—The Baltimore Section of the American Institute of Electrical Engineers held a meeting last Friday evening, Nov. 19, in the Physical Laboratory of the Johns Hopkins University, at which a paper was read on "The Relation of Synchronous Apparatus to Power Factor Adjustment," by Mr. L. F. Deming, district engineer of the General Electric Company. The reading of the paper was followed by a general discussion in which lively interest was shown. The committee on papers and meetings has arranged a program of papers to be presented during the next six months. A committee on sociability was also appointed to provide opportunities for social intercourse among the members of this section.

PERILS OF THE TELEGRAPHER.—The current issue of *Everybody's Magazine* contains an article entitled "Heroes of the Telegraph Key," which should serve to attract to the telegrapher's calling youths whose inclinations have been toward the career of a pirate of the Spanish main or a scout of the bloody trail. The writer apparently exhausted the dictionary in his search for lurid words, and the tale has the movement of a Bowery drama, to the patrons of which it should strongly appeal. The following is an extract somewhat less hysterical in tone than the article in general, and relates to a fire which occured over a room in which telegraphers were working: "In a corner of the room stood the dynamos that generated the current unleashed in dots and dashes through wires crisscrossing earth. Water on these, and they, too, would have been short-circuited and the terrific voltage necessary to hurl the current throughout the system would have been shot through the bodies of the men. With a roar, out of each key would have sizzled a white-hot flame, and like the snapping of fingers the 800 would have been flashed into eternity as if they had been strapped in so many executioners' chairs."

MUNICIPAL EFFICIENCY.—A municipal efficiency commission, appointed by Mayor Busse, of Chicago, earlier in the year, has made its report. Various recommendations are made for the improvement of the municipal service. One of these is that the police patrolmen be required to do a greater amount of routine inspection in relation to sidewalks, pavements, hydrants, sprinkling, street lights, building construction, sanitary conditions, danger to persons and property from overhanging signs, etc., speeding vehicles and the smoke nuisance. It is proposed that the patrolmen make daily reports on these subjects on blanks provided. The police reports will greatly enlarge the city's general inspection service. All departments will have valuable first-hand sources of information, to be followed by technical departmental inspection. For instance, public-service companies will be required to exhibit permits for street opening and the policemen will also report street lights out of service, broken lamp-posts, etc. The commission is composed mainly of city officials, but Mr. B. E. Sunny, president of the Chicago Telephone Company, and Mr. Charles G. Dawes, interested in several public-utility companies outside of Chicago, are also members.

OHIO ELECTRIC LIGHT ASSOCIATION.—The executive committee of the Ohio Electric Light Association will early in January fix the place for the next meeting of the Ohio Electric Light Association. The choice will probably lie between Cleveland and Cedar Point.

DEMAND FOR TECHNICAL GRADUATES.—The demand for this year's graduates from the Massachusetts Institute of Technology was much greater than could be met. Of the 61 receiving degrees as mechanical engineers, each man had the choice of at least two positions; and the summer school of mining engineering had to be abandoned because of the imperative demand for mining engineers.

STREET-LIGHTING TROUBLES IN WAUKEGAN, ILL.—As a result of the action of the voters of Waukegan, Ill., in defeating a $55,000 bond-issue proposition the Mayor of that city, it is reported, has directed that all street lights be put out of commission. The North Shore Electric Company does this lighting, and it has agreed not to turn off the lights at present. It will continue the service and take its chance of collecting its pay.

DROUGHT AFFECTING WATER-POWERS.—Drought conditions throughout the country are already causing some alarm among water-power companies, and unless copious rains come soon many industries depending upon water-power will be forced to suspend. In Sussex County, N. J., only one electric light company among all those in the county depending upon water-power has thus far held out from resorting to steam. This is the Branchville Electric Light Company, which is run by water drawn from Culver Lake.

CHICAGO JOINT ENGINEERING MEETING.—The next joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers will be held at the rooms of the former in the Monadnock Building on Dec. 17. The speaker of the evening will be Mr. R. H. Rice, assistant division engineer of the Board of Supervising Engineers, Chicago Traction, whose subject will be "Low-Tension Street-Railway Feeder Systems." These joint meetings in Chicago are proving very successful and will no doubt be continued throughout the winter.

CHANGING 100,000 TELEPHONE ADDRESSES.—The new system of street numbering adopted by the city of Chicago and effective Sept. 1, 1909, has made a great deal of work for the telephone company. There are over 200,000 addresses in the Chicago telephone directory, and more than half of these were changed by renumbering. In order to issue the fall edition of the directory without delay, the work of changing the addresses was done under great pressure. It will be remarkable if no errors are found in the new directory, and the Chicago Telephone Company requests that it be notified in writing of any discrepancy that may be discovered.

ELECTRICAL GROWTH IN MEMPHIS.—According to records kept by the city officials, the year 1909 promises to be a record-breaker in the amount of electrical construction in Memphis, Tenn. During the year 1908 2861 permits were issued for electrical work in Memphis, and judging by the number so far recorded, the total for 1909 will run to 3000 or over. Probably by the end of the year electrical work to the amount of nearly $1,000,000 will be under way in Memphis. It is also noticeable that the demand is for a better class of electrical work than ever before. A number of large buildings have been wired during the year, and there has been a decided increase in the number of electric elevators installed in buildings.

CHICAGO ELECTRICAL SHOW.—Prospects for the fifth annual Chicago Electrical Show to be held in the Coliseum on Jan. 15 to 29, 1910, appear to be bright. It is said that little effort will be required to fill all the available space in the large building with exhibits, and that 30 per cent more exhibitors have signed applications for space for the 1910 show than had signed for the 1909 show at the corresponding time last year. An entirely new scheme of decorations is being prepared, and so far as can be judged, the exhibition will be attractive and successful. The electric-vehicle people appear to be manifesting more interest than in previous shows, and there will be undoubtedly a number of exhibits of electric automobiles and auxiliaries.

PITTSBURGH A. I. E. E. MEETING.—At the regular meeting of the Pittsburgh A. I. E. E. Branch, on Nov. 9, papers were presented by Mr. H. N. Muller, electrical engineer of the Allegheny County Light Company, on "Applications of Concrete to Central-Station Systems"; by Mr. F. W. Scheidenhelm, consulting construction engineer, on the "Uses of Reinforced Concrete in Railway and Power-House Work," and by Mr. Stephen Q. Hayes, engineer with the Westinghouse Electric & Manufacturing Company, on "Concrete Construction in European Power Plants." The papers were discussed by Messrs. W. M. Kinney, of the Universal Cement Company, and Mr. B. P. Rowe, of the Westinghouse Electric & Manufacturing Company.

A BOY'S FATAL DARING.—The necessity of teaching children, particularly boys, the danger of touching any electric wires was again illustrated by the recent death of a boy named Gustave Nash in Chicago. The boy was 12 years old, and was the leader in the familiar boys' game known as "follow the leader." To accomplish an extra-hazardous feat, he climbed an electric-light pole and when near the top lost his balance and, to save himself from falling, seized with both hands a wire carrying electricity. The boy fell to the ground heavily and struck on his head and died in a hospital two days later. The moral of such incidents as these is obvious: Instill in the minds of children such a wholesome respect for electric wires that they will keep away from them.

A REMINDER OF THE "COLD MOTOR."—A receiver's notice in relation to the claims against the Bidwell Electric Company, an insolvent corporation, brings to mind the litigation growing out of the exploitation of the notorious Benson "cold motor," as a result of which the Bidwells, father and son, received penitentiary sentences for operating a confidence game. The receiver gives notice to all persons having claims against the Bidwell Electric Company to present them in writing to the Circuit Court of Cook County, Ill., on or before Nov. 29. Claims must also be filed with Mr. H. R. Kent, 134 Monroe Street, Chicago, who is the ancillary receiver. Not only creditors but stockholders are notified, and stockholders are further informed that their claims must be limited to the actual amount of money they have paid for their shares of stock.

LIGHTNING ON THE ISTHMUS OF PANAMA.—Accidents due to lightning are rather numerous on the Isthmus of Panama, and a committee of engineers has been appointed to consider the practicability of installing lightning arresters on telephone and electric light lines. During the last three summers over a dozen men have been struck by lightning and killed or injured. The division engineer of the Central Division, Department of Sanitation, Isthmian Canal Commission, expresses the belief that some of the men who died might have been saved had there been present at the time persons familiar with the proper means of resuscitating human beings injured by lightning. There seems to be a general opinion among the canal employees that there is no use in attempting to do anything for a man injured by lightning except to take him to the nearest hospital. Rules for resuscitation of persons struck by lightning have now been printed in English, French and Spanish and posted at conspicuous places along the line of the canal.

Central-Station System of the Easton Gas & Electric Company.

EASTON, Pa., has a population of 35,000. The city is situated at the forks of the Lehigh and Delaware Rivers and is in the center of a thickly settled section with a population of 60,000 comprising the city of Phillipsburg, N. J., which is on the opposite side of the Delaware River and the former borough of South Easton across the Lehigh River from the city proper. Closely adjacent is the center of the cement industry of the United States and also one of the greatest slate-producing regions of the country. The city is rich in pole lines, for it possesses two telephone companies, two telegraph companies and three electric light companies, and all the circuits are overhead. The public lighting in the city of Easton is looked after by the municipality, there being 325 Westinghouse magnetite arc lamps fed from a municipal plant equipped with four Western Electric arc machines rewound for the 4-amp lamps; but the city is not a competitor for commercial or private lighting.

The two electric light companies operating in Easton besides the municipal plant are the Easton Gas & Electric Company and the Eastern Pennsylvania Power Company. The latter company has acquired the steam generator plant of the People's Consolidated Service Corporation of Easton. This company has a station on Dock Street and the Lehigh River in which 700 kw in direct-current machinery and 100 kw in alternating-current machinery is installed. The station is operated non-condensing and the exhaust steam is sold for heating purposes. At present the station is being enlarged by the addition of a 750-kw Curtis turbine set and the necessary boiler equipment.

The Easton Gas & Electric Company is the largest operating company in Easton and has two electric stations. The electrical department is a consolidation of the Edison Illuminating Company and the Easton Power Company. From the Edison Company it acquired the steam plant on Ferry Street, and from the Easton Power Company the water-power plant in South Easton. At the time, the Ferry Street plant was equipped with the usual multitude of high-speed simple and compound engines, belted to Edison bi-polar generators for 110-220 volt lighting circuits, and a 550-volt generator for street railway work. The water-power plant at South Easton was equipped with three McCormick turbines belted to alternating-current generators.

When the present company assumed control neither of these plants was in a satisfactory condition, both as regards capacity and economy. Two years were spent in experimenting with gas engines and producers, and although the fuel economy of the gas-engine plant was good, the installation was in other respects a failure. It was then decided to have one generating plant by adding to the water-power station in South Easton a steam-turbine equipment, and to convert the Ferry Street station into a substation. Accordingly, in 1905, two 500-kw Curtis turbines, with boilers, condensers, etc., were installed, and two years later this equipment was doubled and the entire hydraulic plant at South Easton rebuilt. Last year step-up transformers were added to the station equipment in South Easton, and transmission lines built to the old Moravian city of Nazareth and to Butztown. Two 1100-volt, three-phase lines run from the generating station to the latter cities, which are about eight miles away. At Nazareth the voltage is stepped down to 2300 volts, two-phase, to supply the electric load through the local electric light company's station, and at Butztown a synchronous converter is installed for feeding the railway.

The South Easton generating station is located on a strip of land between the Lehigh Coal & Navigation Company's canal

FIG. 1.—GENERAL VIEW OF STEAM-TURBINE ROOM IN EASTON GAS & ELECTRIC COMPANY'S STATION.

and the Lehigh River. The present hydraulic equipment comprises two double-runner, 48-in. Smith horizontal water turbines, direct-connected to two 500-kw General Electric, 2400-volt, two-phase, 60-cycle, revolving-field alternators, and one 24-in. McCormick turbine belted to a 120-kw Westinghouse alternator of the same characteristics as the other units. The turbines are connected to the forebay in the Lehigh Coal & Navigation Company's canal by 11-ft. steel penstocks 150 ft. long. The wheels are controlled by Lombard governors, but, owing to the difficulty experienced from time to time with water, the steam turbine units are permitted to do the governing. The plant operates under a head of about 20 ft., the tail race emptying into the Lehigh River, and the distance between the forebay and the tailrace at the site being about 200 ft.

The steam portion of the station consists of four 500-kw, two-phase, 60-cycle, 2400-volt Curtis turbo-generator sets, equipped with oil step bearings and hydraulic valve gear. Steam for these units is supplied from four 400-hp B. & W. boilers, fitted with superheaters and Treadkill shaking grates. Buckwheat coal for the plant is received in canal boats on the Lehigh Coal & Navigation Company's canal. A clam-shell bucket and a Hunt automatic railroad are used in unloading the boats, and the fuel is dumped in a storage yard capable of holding about 10,000 tons. During the navigation season the coal runs by gravity from the yard to a bucket elevator, which delivers it to an overhead tank, whence it is discharged into charging cars through chutes. These cars pass over scales and are weighed on their way to the boilers. The latter, needless to state, are hand fired directly from the charging cars. Two 7-ft. A. B. C. fans furnish forced draft for the furnaces. The ash pits have inclined bottoms, so that the ashes are discharged by gravity into ash cars in the basement, which are dumped on the land back of the plant. Up to the present time contractors have hauled the ashes away as fast as they have been deposited without cost to the company. Feed water is pumped from a tank connected to the hot well by two outside center-packed Fairbanks-Morse pumps, controlled by Vigilant feed-water heaters.

The steam turbines are equipped with Alberger counter-flow surface condensers, with automatic hot wells and two-stage, dry-vacuum pumps. Because of the peculiar location of the plant circulating pumps are not required, the cooling water be-

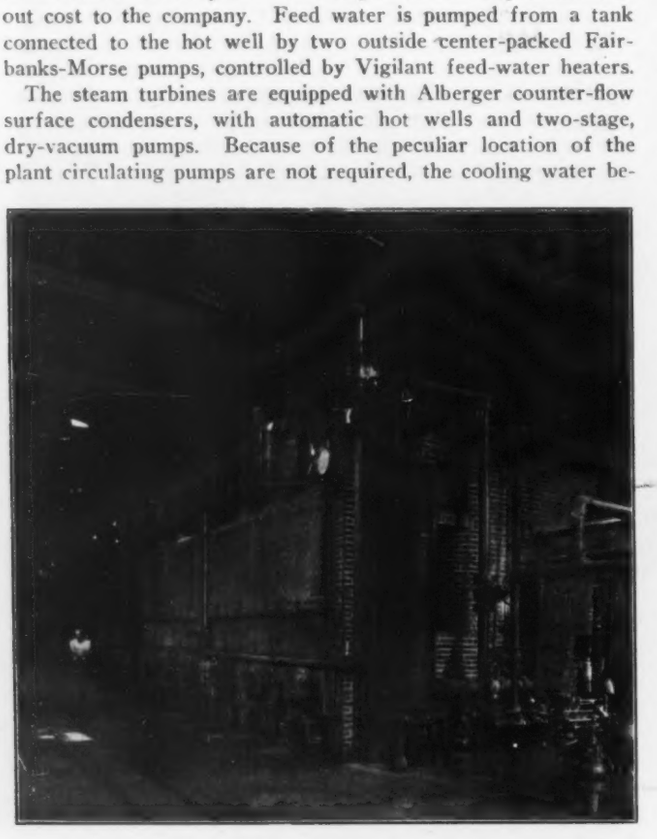


FIG. 2.—BOILER-ROOM EQUIPMENT.

ing siphoned from the canal through the condenser to the Lehigh River. Jacket water for the vacuum pump is obtained in the same way. Make-up water is added to the condenser by means of a by-pass between the steam and water chambers, which also serves to keep the siphon free from air. In the condenser arrangement the water from the canal enters at one end and at the top of the condenser, and is discharged at the bottom of the opposite end. The steam enters at the bottom, and the dry vacuum pump connection is made at the top, so that the air removed by the pump is dry and cool. The auxiliaries, including the dry-vacuum pumps, hot-well pumps, step-bearing pumps, boiler-feed pumps and blower engines are steam driven,

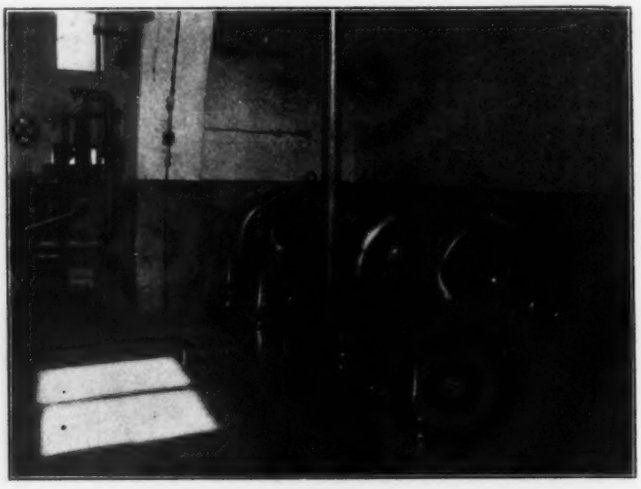


FIG. 3.—MOTOR-GENERATOR EXCITER UNITS.

and their exhaust is passed through a closed feed-water heater. The exciter equipment comprises two 40-kw, motor-driven machines, controlled by a Tirrill regulator, and a 35-kw steam-turbine set, which is used as a reserve or to start the plant in case of a complete shut-down. The hydraulic and the steam-driven generators are run in parallel at all times.

Eight sets of feeders leave the generating station at South Easton. The territory immediately surrounding the station is fed through three two-phase lines. There are triplicate sets of feeders running to the Ferry Street station, where motor-generator sets convert the energy into direct current for the Edison and railway services. There is about 200-kw in Edison machines in the Ferry Street station, and the railway load carried is approximately 700 kw. A Gould storage battery with booster is used to even up the load on the railway circuits. The territory for the most part is served by a system of alternating-current distribution, the three-wire, direct-current system only covering the lower part of the town, and serving an area of about five blocks long by four blocks wide. Phillipsburg and the borough of South Easton are served wholly by alternating current, which is transmitted at 2200 volts, two-phase, 60-cycle. The company has the public lighting contract in the city of Phillipsburg, which calls for 135 6.6 amp, alternating-current, series-arc lamp.

In October, 1908, the Easton Gas & Turbine Company passed under the control of the Doherty Operating Company. A new business department was immediately formed under the supervision of Mr. D. M. Coughlin, who was formerly associated with the Denver Gas & Electric Company, and a corps of 10 men, each expert in his particular line, is maintained. The campaign conducted during the past year has been almost wholly devoted to fuel gas appliances, although some time has been given to the electrical development to advantage. As showing what has been accomplished in this direction, it might be stated that during the past year a trifle less than 2000 kw has been added to the connected motor load. A large portion of this business has been obtained in silk mills, of which there are quite a number in Easton. Mr. Roy A. MacGregor, the power specialist, has given his time to developing as high a load factor as possible with the opportunities of business at hand. One very desirable feature which has been added consists of 200 kw in motors connected to pumps, which run between the hours of 10 p. m. and 7 a. m., and serve to fill up, to some extent, the midnight valley of the load curve. There is more of this business to be had around Easton, which will be acquired shortly. Since the Doherty interests have taken control, the station has

increased its output 45 per cent over the same period last year. The load factor at the present season is between 60 and 70 per cent.

Up to this time the spectacular electric lighting end of the business has received no great amount of attention, owing to the

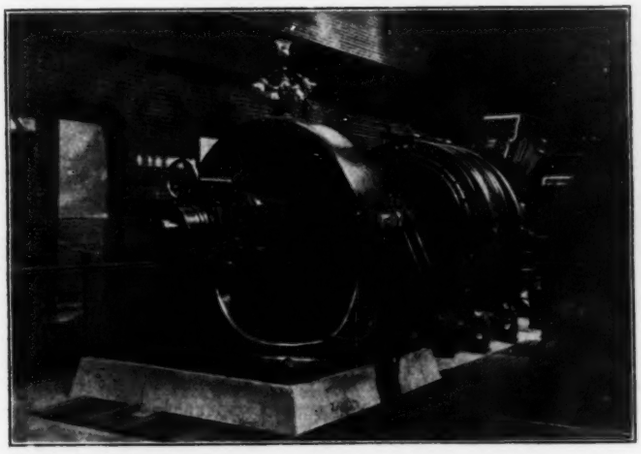


FIG. 4.—SUBSTATION EQUIPMENT IN FERRY STREET PLANT.

fact that the acquisition of an outline sign and decorative lighting load has been seriously handicapped by a restricting sign ordinance, and owing to the opportunities for the development of the gas end of the business nearly all of the energies of the new-business department have been exerted in this field. The increased electrical load has been acquired wholly by personal solicitation, and in no case has it been found necessary to loan equipment or to place motors on trial. All motors have been sold outright, and thus far are giving excellent satisfaction, which is borne out by a series of testimonials and photographs on file in the Easton office. The energy base rate for lamp circuits is 7 cents, subject to varying discounts, and the base rate for motor circuits is 5¾ cents.

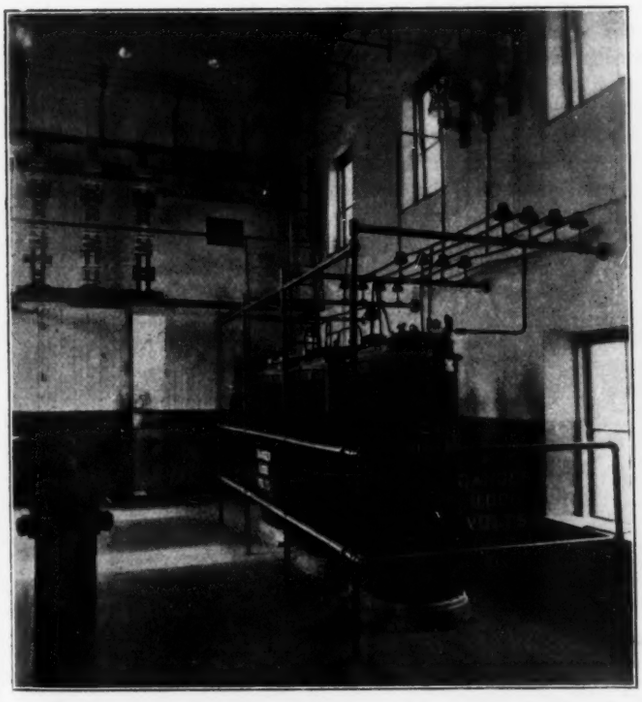


FIG. 5.—STEP-UP TRANSFORMERS FOR NAZARETH AND BETHLEHEM LINES.

The company operates two immense signs in Easton, one over the old office on Center Square, 25 ft. by 20 ft., and containing some 600 lamps. A flasher is installed in connection with the sign. First a goddess appears in white frosting, then a flash of green forked lightning shoots from her hand and the word "Easton" appears; successive strokes of lightning throw out two additional lines: "Gas & Electric Company" and "Come In," followed by a red border. A big slogan sign erected on the roof of the company's storehouse on the river front, and facing all of the railroads coming into Easton, was presented to the

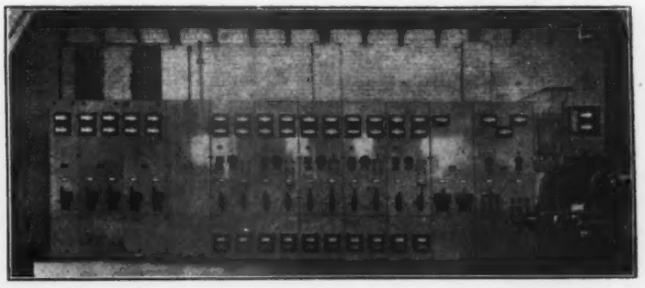


FIG. 6.—SWITCHBOARD IN MAIN STATION.

city by the company about a year ago. The sign measures 54 ft. x 45 ft., and contains 2000 lamps. The slogan reads, "Easton, City of Resources," and the sign has a rising sun effect and double arrows. First the arrows shoot out from the center, and then a red sun, shading off in the rays to a pale pink, appears, and as the words come the sun dies out, leaving the slogan burning. Mr. B. F. Cresson is general manager of the company, and Mr. E. L. Franklin is superintendent of the electrical department.

On the first of the month the company moved its offices to the old post-office room in the Seip Building, adjacent to its old office in Center Square. The office measures 37 x 117 ft., and extends from the Square to Church Street. Two large display windows front on the Square, and afford ample room for exhibiting appliances for home use. The front half of the office is fitted up as a sales display room, and a partition in Mission effect, studded with leaded glass, separates the sales-

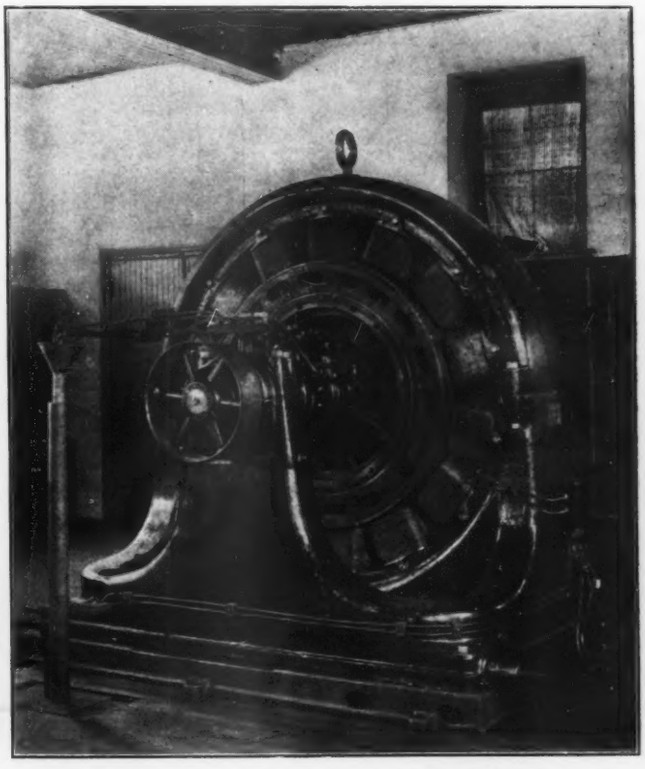


FIG. 7.—VIEW OF 120-KW UNIT DRIVEN BY WATERWHEEL.

room from the executive offices. A feature of the general office is a dark room fitted up for displaying gas and electric fixtures. On the first of the month invitations to the opening were extended to the public through the daily papers, and the crowds that responded were a revelation to the company. Its new offices are among the handsomest in Pennsylvania.

Location of Faults in Underground Cables.

By William A. Durgin.

With the increasing use of high-potential underground circuits for energy transmission in large cities and the multiplication of substations and the consequent complication of the cables in duct lines and manholes, the need has been felt of a test method by which any given cable can be identified throughout its length. Disasters to the system, and even fatalities, have resulted from wrong identifications which, unfortunately, can never be entirely eliminated by the most careful system of records and drawings.

Such a test method must evidently consist of some form of signal which can be sent over the cable from one terminus with sufficient strength to affect a receiving apparatus held on or near the sheath at any point. Various combinations have been suggested from time to time in connection with schemes for fault location, the signal-sending devices ranging from a series-arc generator, as described in Mr. Henry G. Stott's paper, page 829, Volume 18, A. I. E. E. *Proceedings*, to an electrolytic interrupter, and the receivers from an ordinary compass to some form of exploring coil, with or without iron core, in combination with a telephone receiver. However, all these methods depend on detecting the variation in the magnetic field of a pulsating or interrupted current, and all are subject to serious interference from sheath ground currents which either produce erratic phantom signals or a marked diminution in the sensitiveness of the receiver. In all, too, the sending device is limited in capacity to currents of a few amperes, so that under the best conditions the signal is extremely weak.

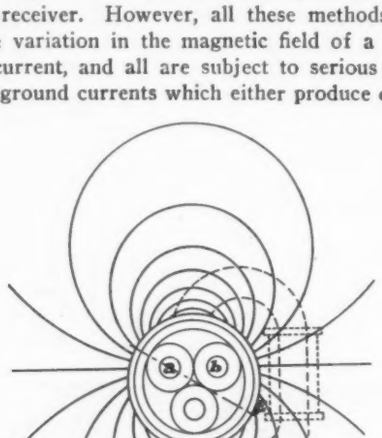


FIG. 1.—MAGNETIC EQUIPOTENTIAL LINES FROM TWO-CONDUCTOR SIGNALING LOOP IN PLANE PERPENDICULAR TO CABLE AXIS.

As in general the cable to be identified will be the only one available for testing purposes between the given termini, the complete signaling circuit must consist of some combination of the conductors or of the conductors and sheath of this cable connected together at one end. Earth, of course, may be used for one side of the circuit, but as the sheath is grounded at many points, "earth" and sheath are practically identical. Investigation of the m.m.fs. resulting from these various available signaling circuits has led to the design of an exploring coil, to be used with a telephone receiver, which entirely eliminates the effect of sheath ground currents—a result completely verified by experiment. For illustration of the method employed, a three-conductor, No. 2-0, 20,000-volt cable will be considered. Each conductor is insulated with 9/32 in. of paper and all three are then enclosed in a 6/32-in. paper belt and a ⅛-in. lead sheath is applied; these relative dimensions are shown in Fig. 1. Of the eight possible signaling loops in this cable, three only need be investigated: (I) that consisting of two conductors—that is, a circuit out over one phase and back over another; (II) that consisting of two conductors in parallel, in series with the other conductor, and (III) that consisting of one conductor and the sheath.

The magnetic equipotential lines in a plane at right angles to the axis of the cable resulting from a direct current over the two-conductor loop are shown in Fig. 1, where *a* and *b* are the current-carrying wires. This is the well-known distribution with opposite currents in two parallel wires and is chiefly of interest here as indicating the correct form of core for a transverse explorer to be used with this circuit as shown by the dotted lines. The magnetic potential at the surface of the sheath beginning at the point *E* and passing around the circumference in anticlockwise rotation is shown in curve *I*, of Fig. 2, an arbitrary unit of potential being used, as relative values only are of importance. Working from this curve it will be noted that an explorer core to connect points of maximum difference of potential must have a span of 180 deg., while the face at the positive maximum must be narrower than is allowable at the negative maximum in order that these faces may short-circuit minimum differences of potential; this interpretation, of course, agrees with that of Fig. 1. However, such an explorer, although much more efficient than any of the forms previously used, is considerably affected by sheath ground-currents. For, since the sheath is strictly equivalent to a conductor at the axis of the cable in producing a magnetic field, the equipotential lines of the ground currents are radial to the cable or the lines of force are circles concentric with the sheath. Many of these lines of force thread the coil of the explorer and, in practice, the composite sheath current produces such loud noises in the receiver that the signal is heard with difficulty.

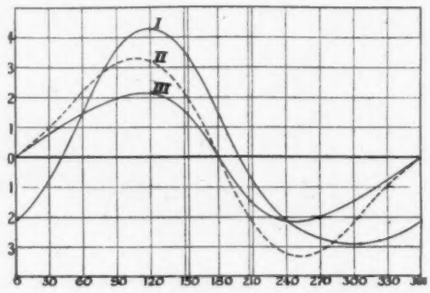


FIG. 2.—DISTRIBUTION OF MAGNETIC POTENTIAL ALONG SHEATH WITH SIGNALING LOOP OF (I) TWO CONDUCTORS, (II) THREE CONDUCTORS AND (III) ONE CONDUCTOR AND SHEATH.

Fortunately, however, cable manufacturers have found it necessary to spiral the conductors, the length of "lay" or of one complete turn of the spiral in the cable under discussion being 20 in. Furthermore, this dimension is approximately the same in all high-voltage three-conductor "power" cables. That is, the field about the entire cable may be represented by the surfaces obtained by moving Fig. 1 along the cable, simultaneously revolving it about the cable axis at the rate of one complete turn for each 20 in. of advance or, passing along a line drawn from the point *E* on the sheath parallel to the axis, the potential again varies according to curve *I* of Fig. 2, the length of lay in an axial plane being equivalent to 360 deg. in a plane at right angles to the axis. If the magnetic equipotential curves in such an axial plane are plotted, the distribution shown in Fig. 3 is ob-

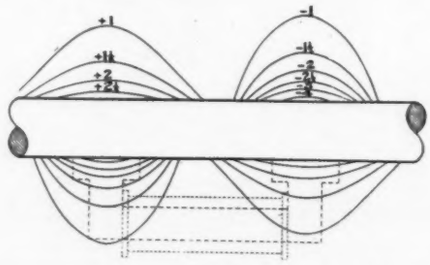


FIG. 3.—MAGNETIC EQUIPOTENTIAL LINES FROM TWO-CONDUCTOR SIGNALING LOOP IN AXIAL PLANE.

tained, and it is at once apparent that an explorer of the form indicated by dotted lines will be as effective in receiving signals as that of Fig. 1, except in so far as the length of air-path for the flux is increased. This new form of explorer, however, has the magnetic circuit at right angles to the sheath ground-current lines of force and consequently is entirely unaffected by them. Fig. 4 shows the explorer as actually constructed, the core having a length over all of 11 in., or slightly more than one-

FIG. 4.—LONGITUDINAL EXPLORER.

half the length of lay. Used in conjunction with a double telephone receiver of about 2000 ohms resistance and a signaling current of 30 amp, a signal of sufficient intensity to be unpleasant to sensitive ears is obtained when the explorer is on the sheath. Consequently, the signal is still loud and unmistakable when the explorer is held about ¾ in. from the sheath or outside the duct tile, every trace of ground current noise being readily eliminated by slightly adjusting the position of the explorer.

The two-conductor circuit considered above is the best loop connection available, not only because it affords the greatest difference of magnetic potential for any given current, but also because the points of maximum and minimum potential are spaced at equal intervals along the sheath, and, with an explorer length equal to one-half that of the lay, points of maximum sound occur twice in each 20 in. Using the loop consisting of two conductors in parallel, in series with the third conductor, the distribution of magnetic potential is as shown in curve *II* of Fig. 2. The greatest difference of magnetic potential is nearly 92 per cent of that obtained with the two-conductor loop, but the maximum and minimum points are spaced alternately 40 per cent and 60 per cent of the lay apart, so that an explorer designed for either interval will be ineffective at the other, and points of maximum sound with either explorer occur consequently only once in 20 in. With the "one-conductor and sheath" loop the maximum difference of potential is reduced as shown in curve *III*, Fig. 2, to 60 per cent of that available with curve *I*, and the maximum and minimum points are spaced alternately 35 per cent and 65 per cent of the lay apart.

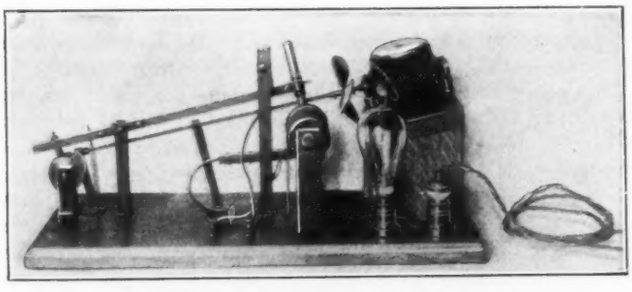


FIG. 5.—CARBON-BREAK INTERRUPTER.

It is necessary to use this last circuit at times, however, and it will be considered again below.

To interrupt the signaling currents of from 1 amp to 40 amp there has been developed a motor-driven carbon-break "flasher" (Fig. 5), which makes and breaks about 70 times per minute and gives a signal resembling the ticking of a clock. The time of break is shortened to about 0.015 second by the use of a combination of the magnetic and fan blow-out, the cooling action of the fan also serving to increase greatly the life of the carbons. Using ⅝-in. carbons the device will run for five hours or interrupt 40 amp at 120 volts 20,000 times without readjustment. This interval is sufficient for the identification of a 20-mile line throughout its length, and eliminates the uncertain interpretation of receiver silence incident to the use of any form of interrupter which may fail during the test. By the use then of the new form of explorer, together with this interrupter, multiple-conductor lead-sheathed cables can be identified with certainty at any point where one side of the duct or sheath is exposed.

The apparatus is also adapted to the location of certain classes of faults in these cables. When the faulted conductor is burned open the Murray loop method, or any of the various modifications used for fault-location tests, are inapplicable and in most such cases the "cut-and-try" method has been used. This method is, of course, generally very expensive and slow, 8 or 10 cuts being sometimes required before the trouble can be located between successive manholes. However, if the conductor is grounded through a sufficiently good path to allow an interrupted current of 8 amp or 10 amp to flow for some time, the explorer method can be applied to locate the point at which the signal stops—that is, the fault which forms the end of the signaling loop. This loop consists of one conductor and sheath and if all the current returns over the sheath the magnetic potential varies, as shown in curve *III*, Fig. 2. The explorer consequently must have a length of 35 per cent or 65 per cent of the length of lay, the shorter being used on account of the less reluctance.

When, however, the sheath of the injured cable is bonded to

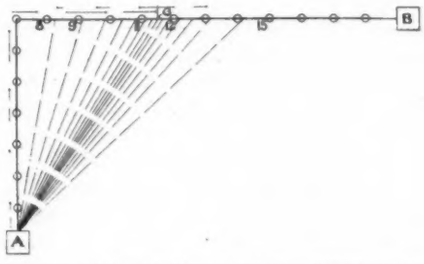


FIG. 6.—FLOW OF SIGNALING CURRENT WITH ONE CONDUCTOR GROUNDED AT "G."

other sheaths to prevent electrolysis, or when the ducts are partially filled with water, the signaling current may spread out over a large sheath network or over the contiguous earth, thereby resulting in a distribution somewhat as shown in Fig. 6. Here the cable connecting the stations *A* and *B* is assumed as broken down at the point *G* between the eleventh and twelfth manholes from *A*. Signaling current is sent from *A* over the conductor, as shown by the long inner arrows, to the fault, where it passes to the sheath and divides, as shown by the outer arrows, a gradually decreasing portion continuing along the sheath toward *B*, while another decreasing portion returns over the sheath toward *A*, all the current eventually reaching *A* over earth paths, as indicated by the dotted lines. Exploring the cable with the old form of coil, a loud signal predominating over sheath ground current noises, will be heard in the first eight manholes. In the ninth, the signal will begin to diminish due to the neutralizing effect of the return current in the sheath, growing weaker in succeeding manholes until at the fifteenth it disappears entirely. No sudden reduction will be observed between the eleventh and twelfth manholes as, if X per cent of the current returns along the sheath toward *A*, $(100 - X)$ per cent of the conductor current is unneutralized and effective in the eleventh manhole in producing approximately concentric lines of force, while in the twelfth manhole nearly $(100 - X)$ per cent of the sheath return current is similarly available. The fault then is located between the eighth and fifteenth manholes.

With the new form of explorer held at right angles to the cable, signals are heard just as outlined above, but when held longitudinally along the cable no signal is obtained in the first

eight manholes, as the longitudinal distribution of flux only holds for a spiraled loop and there is practically only one side of the circuit in this part of the cable. In the ninth, however, a slight return sheath current produces a distinct longitudinal distribution and there is heard a signal which increases with increasing sheath current until in the eleventh manhole it is apparently louder than the transverse signal. In the twelfth and all succeeding manholes, however, the longitudinal position again gives absolute silence and the fault is located with certainty in a single cable length between two successive manholes.

This application has been entirely successful in practice, the only limitation being the occasional difficulty of establishing a good current-carrying ground at the fault. It is sometimes necessary to keep the current within 8 amp to obviate burning off the ground connection, and this limit so reduces the intensity of signal when the explorer is used outside the duct that some skill is required in determining the location. In several cases where two conductors have been open-circuited at the fault it has been possible to fuse them together by means of a high-tension testing set and to use the two-conductor signaling-loop method for location test. In short, although this method does not entirely supplement the Murray loop method, it can be used successfully on "power" cables in a large percentage of the cases heretofore requiring the "cut-and-try" method of location.

The Flicker Photometer.

By Sydney W. Ashe.

THE subject of color photometry has received much consideration of late, the most recent contribution being an editorial in the issue of the *Electrical World* for Nov. 4. In discussing color photometry the flicker photometer is usually suggested as a possible instrument for the purpose, as it is a well-recognized fact that all direct-comparison photometers introduce serious errors. In discussing the direct-comparison methods, the writer always refers to the conclusion* arrived at by Helmholtz, one of the greatest investigators and authorities on physiological optics that the world has ever known, where he states: "I must explain that, personally, I put no confidence in my judgment concerning the equality in luminosity of differently colored surfaces. I admit, however, that of differently colored fields, one can be so much darkened that there remains no doubt that the other is brighter.

Other methods have been suggested besides that involving the use of the flicker photometer, such as the acuity method, for the comparison of differently colored fields. The writer's conclusion in this direction, as a result of many acuity tests, is that they are not sufficiently consistent to be used commercially owing to physiological changes in the individual from day to day, and also to the effects of accommodation and eye fatigue making them unsuitable for commercial testing.

It would seem from a general study of the research work on the subject of color photometry, and from the conclusions of many authorities in reference to this subject, that the only available method is one employing the flicker photometer. It may be that the difficulty with the direct-comparison method lies in the fact that the instant the eye attempts to compare two differently colored fields, the element of fatigue enters the problem, the eye being fatigued more quickly and in greater proportion for one color than for another. It has been shown by Allen, in the *Physical Review* for January, 1909, that it is impossible to fatigue the eye for some colors, such as blue, and also that the amount of fatigue for some other colors, such as yellow, is practically zero. On the other hand, for colors, such as red, the fatigue is quite marked. After an interval of three minutes it is impossible to increase the fatigue of the eye; seemingly there is a saturation point.

Suppose that a red and a blue light are being compared by the direct-comparison method; the red would probably fatigue the eye much more quickly than the blue, which would result in an inability of the eye to compare the two properly. With a flicker photometer the change in fields, say, from red to blue is so rapid that the element of fatigue is undoubtedly eliminated. In the paper previously referred to, the author also noted that the element of flickering for a given intensity of light seemed to be greater for excentric vision. This same phenomenon has been observed by Tufts and many others. In view of the Von Kries theory of rod and cone vision, which has withstood the test of many years, in which color vision appears to be concentrated in effectiveness in proportion to the number of cones, it would seem that for excentric vision the sense of luminosity is greater than for color vision, owing to the absence of the cones. In the early work of Professor Rood, the inventor of the flicker photometer, many experiments were performed to show that the flicker of the flicker photometer was solely a function of brightness. Among these experiments was one in which two differently colored fields were photometered and then superimposed upon each other, the colors being complementary. This color was then photometered with the flicker photometer. The results of this experiment showed that the total luminosity of the resulting color was equal to the sum of the individual luminosities. Professor Rood also held that all individuals were slightly color blind. Dr. Tufts, following up this discovery, obtained by the spectro-flicker photometric method luminosity curves for various individuals, including a few who were badly color-blind. Upon plotting the luminosity curves over one another on the same curve sheet it was noticed that, while the maximum values of the various curves did not coincide, their areas were equal. Each individual seemed to have the same total appreciation of luminosity, but the distribution of appreciation was different.

An interesting experiment has suggested itself to the writer which is now undergoing test, and it is mentioned here so that others may try the same experiment with a view to adding evidence to the proof of the accuracy of the flicker photometer. Upon the two sides of the V of a plaster-of-paris wedge, such as is used in a flicker photometer of the Rood type or a shaped piece of wood, are pasted two colors, a Hering red on one side and a Hering green on the other side, which, to an individual color-blind for these colors, will appear the same. Both colors are illuminated with tungsten lamps of equal candle-power, and the 10 deg. prism of the flicker photometer is set so that it will not rotate. The individual is then requested to make a sitting by the direct-comparison method. As both colors will have slightly different coefficients of reflection, the color-blind person will obtain a balance which will not be midway between the two lights. The position of balance is noted, and the flicker is then placed in operation and a new balance is obtained. The coincidence of this position with the previous setting will lend new evidence to the proof of the accuracy of the flicker photometer. Another test which the writer suggests is to attempt to balance the flicker photometer as ordinarily used, but by looking excentrically, and to compare this setting with the ordinary setting.

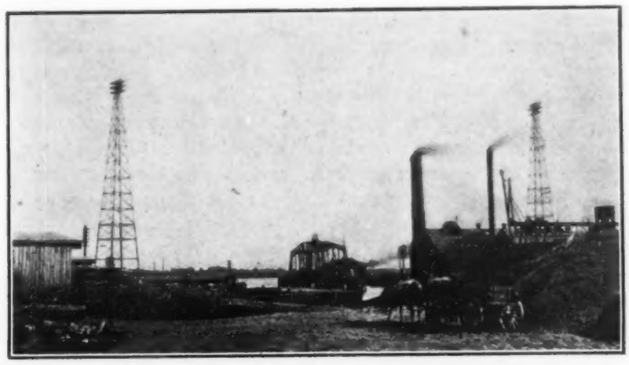
In considering the advisability of using the flicker photometer it is well to realize that, while it is not looked upon with favor by some photometrists, it has received the endorsement of many celebrated physicists and psychologists. In discussing a paper in which the flicker photometer had been used as the standard method, attention was called by one of the discussers to the fact that the method was in favor only at Columbia University and in England. Considering that these two places rank among the highest in the world with physicists, the author feels that this criticism of the flicker photometer, instead of being adverse, is decidedly favorable.

The flicker photometer is an instrument which must be used to considerable extent before an individual can obtain the best results with it. It should not be used in photometering some illuminants, such as an alternating-current arc, a Moore tube or a Cooper Hewett tube, where the illuminant possesses an inherent flicker, as this inherent flicker may not only counteract the flicker due to a difference in luminosity, but exceed it.

* Handbuch der Physiologischen Optik, second edition, p. 440.

Span Over Black River, Port Huron, Mich.

The Port Huron Light & Power Company, of Port Huron, Mich., under the management of Mr. A. C. Marshall, has recently erected two 130-ft. steel towers to carry the company's wires over Black River. This river divides Port Huron into two approximately equal parts. This new overhead crossing replaces a lot of wornout submarine cables and provides for two additional circuits. These towers and the company's power plant is shown in Fig. 1. Mr. Marshall says that the towers figured out considerably cheaper in first cost than a



130-FT. TOWERS TO CARRY WIRES OVER BLACK RIVER AT PORT HURON.

good modern submarine cable job, and also make a generally more satisfactory crossing owing to the peculiar local conditions of river bottom and frequent dredging. The towers are 130 ft. high; length of span, 400 ft.; number of wires, 12; largest wire, No. 4-0; smallest wire, No. 6; highest voltage circuit, 11,000; lowest voltage circuit, 500; maximum sag, 12 ft. The strain of the 4-0 wires is held with 10-in. General Electric porcelain disk strain insulators, the same as are used on the Grand Rapids-Muskegon 110,000-volt line. A No. 0 copper ground wire or lightning rod has been run up the entire height of the towers, projecting 8 ft. above the top and grounded in the mud of the river bottom.

No-Load Conditions in Self-Excited, Single-Phase, Shunt-Induction Motors.—II.

BY VAL A. FYNN.

IN the section of this article which appeared in the previous issue, an analysis was given of the conditions in the single-phase shunt-induction motor when driven uniformly at the exact synchronous speed. Being now thoroughly at home with the diagram shown in Fig. 6 one can go one step further —that is, assume *the motor to run without being mechanically driven* and proceed with the investigation of the true no-load conditions of an ideal motor of the type indicated in Fig. 1 of the previous issue. It has been stated that such a motor requires no *irrecoverable energy* to run it light at a synchronous speed; in other words, the machine will absorb no energy if time intervals covering one or more complete cycles are considered, but the machine may, and does, instantaneously require *recoverable energy*.

Imagine, to begin with, that the rotor is on open circuit and that Z_1 is connected to the mains; then Z_1 will only take a magnetizing current i_m lagging 90 time-degrees behind P, as shown in Fig. 71, page 1288. The same is also indicated in Fig. 72, where the progress of time is measured from left to right, which means that the *lag* is also in that direction. It is well known that when the magnetic field N_1 is being built up, a certain amount of kinetic energy ($W = \frac{1}{2} L \cdot i_m^2$) is stored, which energy is liberated when the magnetic field is destroyed. When the current is an alternating one, as in this case, then the energy taken from the mains and stored during one quarter-cycle is returned to the mains in the next quarter-cycle, and so on.

This is well illustrated in Fig. 72. When the *acting* force, here P, is in the *same* direction as the current, here i_m, then positive work must be done on the field N_1, energy being stored therein. This happens in the time intervals t_2, t_4 . . . During such times work must be done by the alternator feeding energy to the circuit, and the prime mover must exert a torque and act *as a motor*. When the *acting* force is *of opposite* direction to the current, as in the time intervals t_1, t_3 . . . . . then it is N_1 itself which does work, returning energy to the alternator, causing the latter to *drive* the prime mover. The energy returned is proportional to the product, within the times t_1, t_3 . . . . . of the current i_m and of the counter e.m.f. set up by N_1. No energy is wasted in this ideal case, yet a certain amount of energy must be available and that is transferred from the prime mover by way of the mains to N_1 and back again at double the frequency of the impressed e.m.f. (P).

Another point to note is that although Z_1 is entirely devoid of resistance, yet the magnitude of i_m is distinctly limited. This current cannot increase beyond that value which corresponds to an N_1 of such magnitude as will induce a counter e.m.f. exactly equal to P. If i_m were to increase beyond that point Z_1 would be sending more energy back into the mains than it received from the latter. The phase of i_m is determined by the fact that P must not only equal, but also oppose the counter e.m.f. set up by N_1, and since this back e.m.f. lags 90 time-degrees behind i_m, then P must lead i_m by that amount.

Bearing this in mind, consider the motor when running synchronously with short-circuited rotor as shown in Fig. 1. Since N_1 (which, as has been pointed out before, is equal to $v_1 N_1^0$ in an ideal case) is present as before, then the exchange of energy referred to in connection with Figs. 71 and 72 must continue and the same current i_m will flow through Z_1. Along the axis $b\,b$ of the motor there now exists a field N_2 due to the e.m.f. (e_{r_1}) impressed on the rotor winding along that axis, the rotor winding along the axis $b\,b$ thus doing duty as a magnetizing winding. When N_2 is being built up, a certain amount of energy must be stored therein, this energy being afterward liberated.

The diagrams of Figs. 73 and 74 illustrate the requirements of the magnetic field N_2, and are drawn in correct time-phase relation with Figs. 71 and 72, as well as with the following figures, so that all of these may be directly compared, the one with the other. It is seen that energy must be stored in N_2 during the time-intervals t_1, t_3 . . . . and that N_2 liberates energy during the time-intervals t_2, t_4 . . . . The question arises as to the source of and return of this energy for the rotor winding along the axis $b\,b$ is not in inductive relation with Z_1, and no direct transfer of energy can, therefore, take place between the mains and the field winding by way of Z_1.

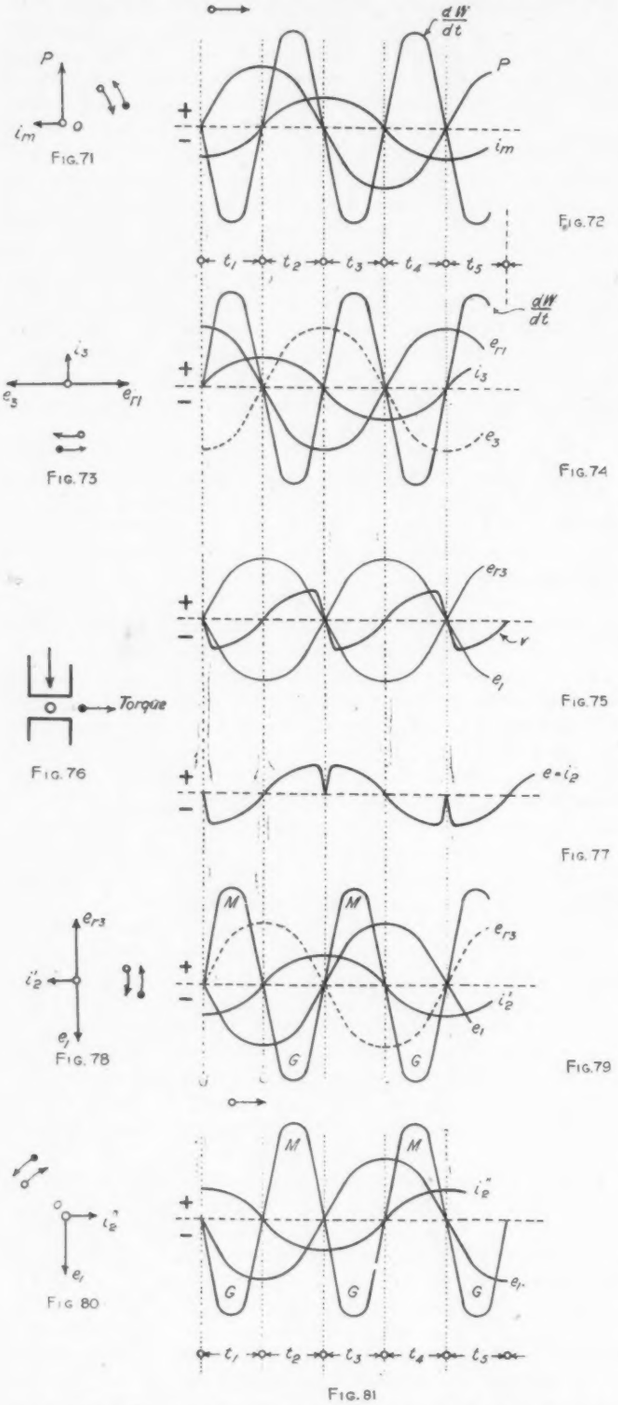
The only possible link between the mains and the field winding is the rotor winding along the axis a. This winding is in a position to receive energy from the mains *inductively* through Z_1 and to transmit this energy to the field winding in the form of *mechanical torque*, or vice versa. Another possibility is an interchange between the kinetic energy stored in the rotor itself ($W = \frac{1}{2} m v^2$) and the kinetic energy of N_2.

It will be appreciated at once that since the rotor will neither receive nor yield kinetic energy without a variation in its velocity, it will never be in a position to supply the whole of the energy required by N_2, nor will it ever be able to absorb all of the energy liberated by N_2 as long as the brushes $a\,a$ are short-circuited. The reason is that as soon as the rotor speed departs ever so little from the synchronous value, the equilibrium between e_1 and e_{r_2} must be disturbed, producing a rotor current along the axis $a\,a$, which current must yield a torque in conjunction with N_2 in one direction or another. It is not quite simple to work out this hypothesis, and the author will be very glad indeed if the train of thought by which the result is here reached be carefully checked by others.

Perhaps the quickest way to arrive at a solution is to consider extreme cases. Let, then, the brushes $a\,a$ be left open circuit and imagine the rotor of the ideal motor to be running at synchronous speed; let this rotor have a certain weight and be left to itself after being brought up to synchronism. As soon as the brushes $b\,b$ are short-circuited, and Z_1 is connected to the mains, N_2 will appear along the axis $b\,b$. The whole of

the energy required by N_3 when e_{r1} is in the same direction as i_3 (time t_1, t_3 . . . .) must be supplied by the kinetic energy stored in the rotor and will be returned to the latter in full when i_3 is of opposite direction to e_{r1} (time t_2, t_4 . . .).

A reference to Figs. 30 and 40 will show that during the time-intervals t_1, t_3 . . . , when e_{r1} is of the same direction as i_3, the torque due to $i_3 z_2$ and N_1 is negative, but when i_3 is of opposite direction to e_{r1}, during the time-intervals t_2, t_4 . . . , then it is seen, from Figs. 31 and 44, that the torque between $i_3 z_3$ and N_1 is positive. The number of turns in the windings Z_1, Z_3 are designated throughout by z_1, z_2. In reading the diagrams referred to it should be remembered that i_3 is of the same phase as N_3 and coincides in space with e_{r3}, and that the rule as to the direction of a torque is illustrated in Fig. 76. If e_{r1} and i_3 vary harmonically with time, then the impulses on the rotor will vary likewise and the velocity v of the latter will presumably oscillate harmonically about the synchronous speed with the same frequency as that of e_{r1}. A sine curve leading e_{r1} by 90 time-degrees may then represent the variation of v. The amplitude of v will depend on the mass of the rotor and will be infinitely small if m is infinitely large. No irrecoverable energy being expended, the rotor will continue to rotate indefinitely, but its velocity will not be uniform. If m is zero, the rotor must come to a stop, for it cannot supply the energy required at the time when N_3 is building up.



Figs. 71 to 81.—Time-phase relations in self-excited, self-compensated, single-phase shunt induction motors.

Consider, now, m to be zero while the brushes $a\,a$ and $b\,b$ are short-circuited and the rotor is running at synchronous speed. Such a rotor will have no kinetic energy stored in it. Since in the time-interval t_1 (Fig. 74) energy is being stored in N_3 it is certain that the rotor speed will drop during that time. This drop in speed will not affect the magnitude of e_1, but will reduce that of e_{r3}, which is proportional to the square of the instantaneous speed, the synchronous being taken as unity. The resultant e.m.f. in the rotor along the axis $a\,a$ will now differ from zero and be of same direction as e_1, thus $e = e_1 - e_{r3}$. The rotor along that axis being devoid of reactance, a current, i_2', proportional to and cophasal with e will result and be of same direction as e_1. Now a current of same direction as e_1 produces, as is known, and as is shown, for instance in Figs, 35, 39, 43 and 47, a torque of such a direction as to accelerate the rotor—that is, a positive torque and i_2' will consequently be in a position to yield the energy momentarily required by N_3, this energy being derived from the mains by way of Z_1. In fact, the product $i_2' \times e_1$ (which represents energy) must at every instant be such as to equal the rate $\frac{dW}{dt}$ at which energy is being stored in N_3 during the time t_1, and which rate is shown in Fig. 74. This relation gives a criterion as to the manner in which the speed must vary about the synchronous during the time t_1; the resulting speed variation is indicated in Fig. 75 on an exaggerated scale. The simultaneous variations of e_1 and e_{r3} are also roughly shown in that figure, but the effect of the speed variation on e_{r3} is not indicated.

During the next interval of time, t_2, energy is being liberated by N_3 at the rate at which it was stored during the time t_1, for i_3 is now of opposite direction to e_{r1} and produces, in conjunction with N_1, a torque in such a direction as to accelerate the rotor. The speed rises, owing to this acceleration, causing e_{r3} to exceed e_1; the resultant e along the rotor axis $a\,a$ now coincides in direction with e_{r3}, and i_2' being cophasal with e is also of the same direction as e_{r3}. However, a current of the same direction as the back e.m.f. e_{r3} produces a negative or retarding torque, for the machine then acts like a generator, returning energy to the mains by way of Z_1. It is in this manner that the energy liberated by N_3 is returned to the mains.

The above process repeats itself in the next half-cycle, and as a result of the velocity v oscillates about that corresponding to the synchronous speed at the rate indicated in Fig. 75, the frequency of these oscillations being double that of e_1 or P. The actual speed n, or the revolutions per second, remain constant.

The resultant e, however, varies somewhat differently. When the speed drops during the time-interval t_3, e_1 exceeds e_{r3}, as was the case within the time t_1, but since e_1 is now positive and not negative, as was the case then, e itself becomes positive. Similarly, e will be negative during the time t_4, whereas it was positive during the time t_2. The actual variation of e and, to a different scale, also that of i_2', is shown in Fig. 77. Of course, i_2' is faithfully reproduced in Z_1, but appears there as being of opposite phase to i_m on account of the transformer relation between the stator and the rotor. The presence of i_2', therefore, reduces the actual current taken by Z_1.

In an ideal motor the necessary variation of v, when $m = o$ for the rotor, should be infinitely small and it is a question whether it cannot then be said that the current i_2' is equal in magnitude to i_3 and leads e_1 by 90 time-degrees, as indicated in Figs. 78 and 79. A reference to Figs. 30, 43 and 76 will show

that the torque due to $i_2' z_2$ and N_3 is positive during the time-intervals $t_1, t_3 \ldots$, and Figs. 31, 47 and 76 show that it is negative during the time-intervals $t_2, t_4 \ldots$. This torque is, therefore, in a position to supply the *recoverable energy required by* N_3.

If such is the case, then we may say that *the recoverable energy required by* N_3 *in an ideal shunt induction motor, the rotor of which is infinitely light, is represented in the primary winding of the machine by a current vector equal in magnitude to the magnetizing current of the motor field and of opposite phase to the magnetizing current of the transformer field.*

If m is not zero, then it would appear that the energy periodically required by N_3 must in general be partly derived from the kinetic energy of the rotor, being restored to the latter in due course, and partly derived from the mains by way of the rotor axis $a\,a$ and the primary winding Z_1, being eventually restored to the mains through the same vehicles. Under these conditions the amplitude of i_2' would be diminished by an amount corresponding to the energy stored or liberated by the rotor during the variations of v. When the kinetic energy stored in the rotor is infinitely large, then i_2' becomes infinitesimal.

In a practical machine $\frac{1}{2} m v^2$ will, as a rule, be great as compared to $\frac{1}{2} L i_2^2$, and the rotor will have ohmic resistance; the variation of v must then be comparatively great in order to produce a current i_2' of appreciable magnitude; it is, therefore, reasonable to suppose that in some cases nearly the whole of the recoverable energy required by N_3 will be supplied by the kinetic energy of the rotor.

The velocity of the rotor of such a machine cannot be constant unless a current i_2', *equal in magnitude to* i_3 *and leading* e_1 *by 90 time-degrees, is present in the rotor along the axis a a.*

Assuming that $i_3 = i_m$ and that a current $i_2' = i_3$ does exist at no-load in the rotor along the axis $a\,a$, then the primary no-load current of an ideal motor, the rotor velocity of which is constant, will be zero. If this velocity is not constant, then the primary no-load current will increase with increasing amplitude of v, but will never reach the value $i_m + i_3$. It will approach this value more and more as $\frac{1}{2} m v^2$ increases in comparison to $\frac{1}{2} L i_3^2$.

It will be shown in a subsequent article that in the case of a rotor having ohmic resistance, the phase relation of e_1 and e_{r3} is such that the synchronous value of i_3 always tends to be faithfully reflected in the rotor along the axis $a\,a$ by a current which will be referred to as i_2''. The phase position of i_2'' relatively to e_1 is indicated in Figs. 80 and 81. When a current, such as i_2'', is present in the rotor along the axis $a\,a$ then it may be seen by reference to Figs. 30, 43 and 76 that the torque due to $i_2'' z_2$ and N_3 is negative during the time-intervals $t_1, t_3 \ldots$, and Figs, 31, 47 and 76 show that this torque is positive during the time-intervals $t_2, t_4 \ldots$. It is clear, therefore, that the presence of i_2'', or a component thereof, only intensifies the difficulty of the recoverable energy. The variation of v must now be so much greater, for the presence of a current such as i_2'' along the axis $a\,a$ of the rotor is equivalent to increasing the energy stored or liberated by N_3.

The difficulty connected with this recoverable energy required by the rotor also exists in the case of practical machines. All of the latter run more or less "uneasily," owing no doubt to the periodic variation of the rotor velocity. One notable exception to this rule is the author's artificially compensated motor, as shown in Figs. 2 to 5, inclusive. When this machine is fully compensated, then the conditions illustrated by Figs. 78 and 79 are fulfilled and the recoverable energy is transferred from the mains to the motor field winding and back again, whilst v remains quite constant.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

"Arc Avenue."

Atlanta's "Great White Way," established at the time of the recent automobile show in that city, has been named "Arc Avenue." It begins at the Terminal Station and runs east along Mitchell Street to Whitehall, north along Whitehall to Peachtree and in the same direction to Ellis Street. Marietta Street, from Peachtree to the Grady Monument, is also included in the scheme of illumination. Flaming-arc lamps are used.

Quick Results on Day Service at Montrose, Col.

The Montrose Electric Light & Power Company, of Montrose, Col., operating in a town of 2500 population, began day service June 1, 1909. Sept. 1, 1909, 154 electric irons had been sold and motors aggregating 86 kw were connected. The revenue from the day service averaged $200 per month from the start, which is enough to pay the expenses of the day run. Such quick returns from a day service are most unusual. Mr. C. K. Durbin, of Denver, secretary of the company, states, however, in this connection that the situation was canvassed very thoroughly in advance and as much day load as possible was secured before service was begun.

Free Wiring at Hobart, Okla.

The following figures regarding free wiring done by the Hobart Light & Power Company, of Hobart, Okla., are furnished through the courtesy of Mr. C. K. Durbin, of Denver, secretary of the United States Light & Traction Company, which controls that property. Over a year ago 42 houses were wired free, the houses containing a total of 216 drops or outlets, or an average of five drops per house. A deposit of $1 per drop was required of the consumer, this deposit to be returned at the end of the year. The total cost was $383, an average of $9.21 per consumer and $1.79 per drop, this covering all the cost of the inside work. The cost of running the outside services, which the company would have to stand in any event, was $4.49 per consumer, and the estimated cost of a meter set was $13. This makes an average total cost of $26.70 per consumer. From these 42 consumers the gross revenue the first year was $784, or $18.65 per consumer. The consumption of energy was 4645 kw-hours.

Since these 42 houses were wired, 100 more houses have been wired for consumers who paid cash for the installation, but got credit on their first year's bills up to an amount not exceeding the cost of the wiring. In other words, these consumers were given current free each month until their aggregate bills equaled the cost of the wiring, after which they would pay the regular rates.

Construction Cost Data of a Municipal Lighting Plant.

The following cost data appear in the first annual report of the Fort Wayne, Ind., municipal electric light and power plant as for the year ending Sept. 1, 1909. The report shows that the original cost of the municipal plant was $165,439.93, to which is added $23,937.71 for service lines, making a total of $189,377.64.

The cost of constructing and equipping the plant is itemized in the report as follows:

Plans and supervising engineer	$6,400.00
Building and grounds	15,906.01

Boilers and attachments	$22,476.67
Machinery	44,226.86
Spy Run dam and basin	2,550.70
Chimney	4,722.34
Switchboard, lamps, transformers	29,281.40
Pole lines, towers, conduits	38,625.35
Tools, supplies, etc	500.11
Incidentals	27.67
Pay roll	334.49
Liability insurance	202.50
Total	$165,254.10

The cost of extending lighting lines and installing commercial service up to Sept. 1, 1909, was as follows:

Poles	$1,708.40
Wire	4,415.40
Meters and transformers	10,894.12
Cross-arms, insulators, supplies and tools	2,217.16
Pay rolls	4,833.79
Wattmeters, lamps, transformers, etc	1,193.28
Total	$25,262.15

The cost of operating and maintaining the plant from and including September, 1908, until February, 1909, was $12,273.10. After Feb. 1 the plant had monthly receipts for services rendered for commercial purposes, in addition to receipts for street lighting at $53 per arc lamp, the total being $20,285.91. The total expenditures were $18,164.88, thus leaving a book surplus of $2,121.03.

Free Show-Window Displays at Rockford, Ill.

The Rockford Electric Company is giving the advantages of its show window for a number of weeks to the various manufacturers in Rockford using electric power. Any manufacturer in the city using electric power may obtain the use of the Rockford Electric Company's show window for one week, the purpose being to enable the manufacturer to familiarize the public of Rockford with the various articles of merchandise manufactured in that city. Incidentally, of course, it familiarizes the public with the large number of factories using electric power. The window is engaged steadily for a period from the latter part of October until well into January, 1910. The window illustrated is the third of the series. The manufacturers when first offered the use of the window were almost unable to understand that the display would cost them nothing but the expense of trimming the window. The illustration is furnished through the courtesy of Mr. F. H. Golding, manager.

WINDOW DISPLAY, ROCKFORD, ILL.

Hotel and Church Signs in Denver.

The accompanying reproduction from a night photograph of the Savoy Hotel, of Denver (Fig. 1), is interesting as showing how thoroughly the Denver hotels have become educated to the importance of electric signs. The Savoy Hotel was one of the first to appreciate this, and the sign on the roof of this hotel, seen in the accompanying engraving, has been one of the landmarks of Denver for a number of years. It is of such size as to be easily read from the Union Depot about a mile distant. The Savoy Hotel being at one end of Seventeenth Street, and the Union Depot at the other, this sign appears to be directly across the end of the street. Besides this roof sign, there is a vertical sign reading "Savoy Café,"

FIG. 1.—SAVOY HOTEL SIGNS, DENVER.

a sign reading "Savoy" over the hotel entrance at the right, and a "Café" sign at the left over the café entrance. The Shirley Hotel sign can be partially seen beyond the Broadway Theater sign at the left, and the sign over the Shirley Annex is barely visible at the extreme right. This being an important corner at the intersection of several streets, the Broadway Theater, which is half a block distant, has placed a sign on the roof at the corner at the left to direct those leaving the cars at this corner to the theater, and to be seen down Seventeenth Street.

Fig. 2 shows how churches and theaters advertise alike in Denver with electric signs. The Trinity Methodist Church, located at the end of a certain street near the down-town district, has placed a very conspicuous sign on its building, so that it can be read by anybody crossing this street within a distance of a half mile. Near it is the sign of the Broadway Theater. Electric signs for churches are used more extensively in Denver than in any other city. The Denver Gas & Electric Company has 8 or 10 church signs, some of which are on the regular flat-rate sign contract and are lighted from dusk to midnight every night, while others are on a meter and lighted only meeting nights. One of the first electric signs in Denver was used for church purposes at the time the old Haymarket Theater was made into a mission. These photographs are furnished by the courtesy of Mr. C. N. Stannard, secretary and contract agent of the Denver Gas & Electric Company.

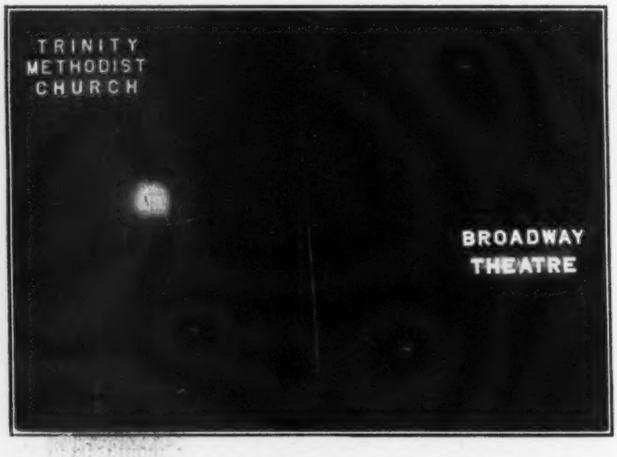


FIG. 2.—CHURCH AND THEATER ADVERTISE ALIKE IN DENVER.

A Factory Lighting Banquet at Grand Rapids.

On Wednesday evening, Nov. 3, the Grand Rapids-Muskegon Power Company gave a banquet to upward of 200 manufacturers from Grand Rapids, a few from Lowell, Mich., and Big

Rapids, and a number from Muskegon, Mich., where the power company furnishes energy for manufacturing purposes to the extent of several thousand horse-power.

One of the objects of this meeting was to stimulate good feeling between the representatives of the power company and the representatives of the manufacturers. The power company, therefore, had about 25 of its different heads of departments present, while many of the guests were superintendents of factories and engineers. In addition, a goodly number of the factory proprietors accepted the invitation sent to them and were personally present.

When the guests entered the banquet hall they saw the tables prettily decorated with Christmas-tree outfits, with the red, white and blue lamps, and about 50 or 60 beautiful portable table lamps with colored shades. After the first course the lights were turned off, and the big manufacturers' monogram of electric lamps was switched on, reading G-R-M, standing for Grand Rapids Manufacturers. This created considerable applause. Among the decorations of the room was the new city flag in numbers. Grand Rapids is proud of its new city flag, and this was the first occasion on which the flag has been in evidence.

Another interesting feature was the installation of several mercury arcs in different parts of the room. All incandescent lamps were thrown off, and the room lighted with these arcs. At first it produced a sensation, and considerable mirth, when it was noticed that the tomatoes were green instead of red, and that the radishes looked like olives. While this created considerable amusement, it nevertheless turned out to be a source of education, as the principal speaker later discoursed on the subject of color values of various lights.

After dinner Mr. H. W. Hillman, who acted as toastmaster, introduced the speaker of the evening, Mr. C. A. Howe, of the Holophane Company. Mr. Hillman reviewed the advances in the art of artificial illumination from the candle to the tungsten lamp. He called attention to the various lighting demonstrations of the evening, and said it was not the intention to conceal the high efficiency of tungsten lamps. The room, it seems, was illuminated with the old-style carbon-filament lamps, consuming practically 3000 watts, and then the same illumination was shown from tungsten lamps, illuminating the room in a better manner, yet consuming a little less than 1000 watts. Another demonstration along similar lines showed equal wattage for both systems of lighting, and gave the manufacturers an idea of the wonderful increase in illumination at the same cost.

Mr. Howe held the close attention of the audience and his remarks were of practical value to all present. The Mayor of Grand Rapids expressed the opinion that it was a good thing for a public-service corporation to entertain its customers in this manner. It could not help but further cement the pleasant relations. He was surprised at the splendid demonstration which could be made with electric lighting.

One of the prominent manufacturers in the audience asked the question, "Why should the power company demonstrate so boldly the economy of tungsten lamps compared with the carbon-filament lamps?" Mr. Howe answered this question in a straightforward, satisfactory manner to the effect that the more the people studied and took advantage of the economies of electric light, the more users would be found for it. Old customers would tell prospective customers of their experience, and the power company would gain new customers. If the people could be educated to use more light, then the power company would be benefited.

In talking with Mr. Hillman after the banquet, he expressed the opinion that lighting and power companies in other sections of the country could hold such banquets to their great advantage. He said they should strike while the iron is hot. Just now the tungsten situation offers an opportunity for the central station to talk superiority and low cost of operation, and the gas companies cannot follow them. He said it would be difficult for a gas company to give such a demonstration. The cost of piping a large room for individual gas mantles to prove equal distribution of light would be prohibitive, if it were possible even to demonstrate by gas. Difficulties of distribution of gas light in factories by individual burners would defeat the purpose of the demonstration. If a gas company was to try such a demonstration it would have to depend upon electric lamps for table decorations. There are so many arguments to prove that a gas company cannot compete with electric companies at the present state of the art that it is wise for the lighting and power companies to take advantage of the opportunity now before them in the matter of tungsten lighting and demonstrations thereof. The electric company is after the factory power, and the expense of such a banquet, as well as the expense of the demonstration, would be well warranted because of the power business which better acquaintance with the manufacturers will bring.

At the speaker's table there were five brass manufacturers. They took particular interest in the new metal reflectors which Mr. Howe demonstrated. These reflectors caused very general and favorable comment. If anyone doubts the question of the ability of gas companies to follow and compete with the tungsten system of lighting, let him think how the Welsbach mantles would operate or fail to operate with the various reflectors which are designed for reflecting the light at any angle wanted for the multitude of machine operations in a factory.

Papers on Rates at Illinois Convention.

At the convention of the Illinois State Electric Association held at Alton, Ill., from Oct. 26 to 28, two papers were given on the subject of electric lighting rates. Mr. M. G. Linn, of the Bloomington & Normal Railway & Light Company, took up the subject for towns of over 15,000 population, and Mr. W. J. Whetzel, of Eureka, Ill., dealt with lighting rates in small towns. Mr. Linn stated that he believes that the two-rate basis is the one that is fair to the consumer and will protect the interests of the stockholders. The two-rate basis encourages the long-burning customer, whether he be a large or a small user, and the long-burning customer is the one to whom energy can be sold at a low rate.

In establishing the two-rate or primary and secondary rate basis, the first thing to be considered is the fixed charges for the primary rate. The secondary rate should be as low as can consistently be made based on the cost of the plant's output.

To determine the fixed charges for the primary rate, one must first determine what is the amount of the investment. For station equipment $125 per kilowatt is usually considered a fair average for this investment for the business district. On this investment one should be allowed a reasonable rate of interest, depreciations and profit; 5 per cent for each of these items should be fair, making a total of 15 per cent. Fifteen per cent of $125 is $18.75 per annum, which is $1.56 per month. The amount to be charged to each customer for the investment in machinery made to serve him may be estimated on the basis of 30 hours use of his connected equipment per month. On this basis the fixed charge would be $1.56 ÷ 30 = 5.2 cents per kw-hour. The secondary rate should be based on the actual cost of energy at the consumer's meter, plus the profit needed.

For example, assume that the secondary rate is found to be 5 cents per kw-hour; the total rate for one hour's use per day would be 5.0 + 5.2 = 10.2 cents per kw-hour. At a discount of about 10 per cent for prompt payment, the following rates could be offered for the indicated hour's use of the connected apparatus: One hour, 9 cents per kw-hour; two hours, 6.75 cents; three hours, 6 cents; four hours, 5.6 cents; five hours. 5.4 cents, and six hours, 5 cents per kw-hour.

The above method of rate making is new to a large percentage of towns in Illinois, and a campaign of education would be needed to insure its adoption. It is in successful use in such cities as New York, Chicago, Des Moines, Omaha and Cleveland.

On account of the larger investment in station apparatus for service in a residence district as compared with a business

district, it is proper to make a larger rate for the residence service. In a town where a rate of from 10 cents to 5 cents could be offered for business service, a rate of from 15 cents to 7 cents could be made for the residence service.

Mr. W. J. Whetzel, in his paper on "Lighting Rates in Small Towns," said that reports received from about 50 central stations in the smaller towns in reply to questions sent out show that there is considerable difference in the charges for energy and in the methods of determining the charge. These variations are evidently not due so much to natural conditions affecting the stations as to the individuality of the management.

The central-station industry would be financially and generally improved by more uniformity of management. The time is in sight when this will be required by law in Illinois as well as in other States. It will remove the opportunity for undesirable comparisons of central stations and result in greater harmony between them and greater equity between them and their customers.

As to the method of determining charges, it is apparent that rates should be computed as simply as the conditions will permit and expressed as simply as possible. This is more essential in a small town than in a city, because customers are not accustomed to dealing with complex problems. However, rates should be revised and devised to prevent waste and encourage more desirable use of energy. If a careful survey of the whole field be made it will be found that rates should be based on the cost of service. Rates so based and properly adjusted afford the best means of meeting competition, since the costs of the several means of producing light and power run nearly parallel.

For the consideration of rates as based on, and adjusted to, cost of service, the following classification of elements of cost will be sufficient. Under the first class are grouped those elements incident to the operation of a plant. Under the second those elements which depend upon station capacity or connected load, being mainly independent of the operation of the plant.

Running Cost	Standing Cost
Labor,	Depreciation,
Fuel,	Profit or Dividend,
Repairs,	Interest,
Operating Supplies { Water, Oil, Packing, Waste, etc.	Insurance, { Fire, Boiler, Damage, Life,
Miscellaneous Items.	Management, Advertising, Rent, Miscellaneous Items.

All of the elements of cost are variable, hence the impossibility of fixing an exact rate. A closely approximated rate cannot be determined unless the elements of cost are considered for not less than a year's time in order to include the variation of the seasons. In a growing plant the elements are more variable and the problem is more difficult. However, the rate may be practically approximated.

The variation between standing cost and running cost is so marked that in order that a rate may be equitable, it must be dual—one part based on the standing cost, the other on the running cost.

A well-equipped plant in a small town requires an investment of about $200 per kilowatt of equipment or connected load. The standing cost as enumerated is about 15 per cent of the investment, or $30 per year per kilowatt of equipment. A consumer who uses 1 kw-hour per day or 365 kw-hours per year should pay as standing charge $30 ÷ 365 = 8 + cents per kw-hour.

The reading of a switchboard meter showing the whole station being divided into the total running cost gives the running cost per kw-hours. With a running cost of 4 cents and a standing cost of 8 cents the total will be 12 cents per kw-hour. The rate for a consumer using his full equipment for two hours per day would be (8 ÷ 2) + 4 = 8 cents per kw-hour. For four hours' use the rate would be (8 ÷ 4) + 4 = 6 cents per kw-hour.

If the maximum demand of each consumer came at peak load, then a simple and equitable way of determining a rate could be arranged according to the preceding illustration. In practice there are many variations. These variations make it difficult to determine the individual dual rate based on standing and operating costs.

Various systems have been devised, each with its own defects. There is the competition plan of getting what can be obtained from each consumer; this plan deservedly and invariably leads to financial ruin. The old flat-rate plan, if followed far, leads the same way by encouraging wastefulness, except when a fixed number of lamps are used for a fixed number of hours under the control of the central station. There is what is known as the discount plan. A straight maximum rate is charged with discount increasing at steps with the increasing amount used. This plan causes overlapping whereby a consumer may, by using just beyond a step, get service for less than if he had ceased before reaching the step. This objection is sometimes overcome by a tabulated charge. This plan with a proper minimum and careful grading has the advantage of uniformity and simplicity and may be so arranged as to conform fairly to cost. The author expressed his preference for a maintenance charge plus a straight rate.

DISCUSSION.

Mr. E. W. Smith, of Kewanee, said that very few companies know what it cost them to produce electrical energy per kw-hour either at the switchboard or at the consumer's meters, and few also know the average rate received per kw-hour. All stations should have switchboard watt-hour meters. At Kewanee the watt-hour meters are read three times each day. By reducing motor rates to a low figure the company had succeeded in filling in the valleys of the load curve during the day.

Mr. John F. Gilchrist, of Chicago, said that the two papers just read indicate a very satisfactory condition throughout the State, because they show that central stations are giving more thought to logical rate making and are coming nearer each year to a uniform basis for establishing rates. The papers bring out the fundamental principle that there should be two factors in the make-up of any rate. One factor is the fixed expense for interest and depreciation and the other factor is the variable or running expense, which is proportional to the kw-hours generated. The problem of universal, uniform rates presents difficulties similar to the adoption of a universal language. Every man thinks his own language or his own system of rates is the best, and does not want to give it up. The speaker then took up the problem of estimating the actual maximum demand of a consumer from his connected load. In a residence the maximum demand is usually from 20 to 30 per cent of the connected load, whereas in stores the maximum may be 60 or 70 per cent. The maximum demand may be measured by means of a demand meter, but the installation of demand meters means additional investment. The investment for meters and service wires for small consumers is already too high. If service is to be extended to large numbers of small consumers, the investment per consumer must be kept at the lowest possible point. The Commonwealth Edison Company in Chicago until recently had maximum-demand meters for each of its lighting customers. During the past year, in accordance with the terms of a recent franchise ordinance, the company has discontinued the use of the demand meters on all installations where the connected load in lamps is 1 kw or less. Having had such a large number of maximum-demand meters in use for a number of years, the company has a large amount of data upon which to base estimates of maximum demand. Accordingly, for consumers of 1 kw and less, the maximum demand is now estimated by means of a table prepared from the averages of 30,000 customers formerly equipped with demand meters. In answer to a question as to the reduction of rates in Chicago, he said that in four years the rate had been reduced from a primary charge of 20 cents for the first 30 hours' use of the maximum demand and 10 cents for the balance, until on Aug. 1, 1909, the rate was made 12 cents for the primary charge and 6 cents for the balance. He called attention to the urgent need for lower-priced meters for small customers to meet present conditions, since electric service is

being extended to a larger number of smaller customers each year. Furthermore, with tungsten lamps, the meter must register accurately for lower current values than formerly. The investment in meters for small consumers may run up as high as $100 per kilowatt of station equipment. A modern steam generating plant can be built for $100 per kilowatt or less, including land, and the distributing system, if overhead, can be built for $100 per kilowatt of station equipment; or $150 if underground. The investment in meters under certain conditions may, therefore, be disproportionate to the rest of the system.

Mr. J. R. Cravath, of Chicago, told of the residence rate used at Lawrenceville, Ill., in which a consumer's maximum demand is estimated to be in proportion to the number of rooms in the house, and not a certain percentage of the lamps connected. The number of rooms is multiplied by 1200 watt-hours each month to get the amount to be billed at 15 cents per kw-hour. A second similar amount is billed at 6 cents, and the balance at 5 cents. This essentially is the plan first adopted in Detroit.

Mr. David Davis, of Litchfield, expressed the opinion that the Detroit system is based on the correct principles.

Mr. E. C. Jenks, of Chesterton, said that it usually costs from 2.5 to 10 per cent to collect bills. His company has successfully worked a plan whereby the regular rate is 20 cents per kw-hour, with a discount of 33 per cent or more according to the size of bill if paid within 10 days. Mr. Frank J. Baker, of Chicago, asked if Mr. Jenks was able to employ such a large discount without complaint. Mr. Jenks replied that he was, and Mr. Baker offered his congratulations. In Mr. Baker's experience it is an absolute impossibility to cause consumers to pay such a large penalty for failure to pay bills promptly. The customers maintain that it is unreasonable to give such a large discount, and he agreed with them.

A question was asked of Mr. Linn as to the investment per kilowatt of station equipment mentioned in his paper. Mr. Baker thought the value too low for average conditions. As Mr. Gilchrist has recently said, the investment in meters alone might amount to $100. In taking over and consolidating a large number of small electric lighting properties, Mr. Baker had found the greatest element of weakness to be the inaccuracy of consumers' meters. If a consumer's meter is slow, the company is unwittingly discriminating in favor of that consumer. When consumers compare notes the difference in bills is evident and creates dissatisfaction.

Mr. H. J. Pepper agreed with Mr. Baker as to the impracticability and undesirability of a large discount for prompt payment. If a consumer who had forfeited such a large discount should take his case to court the company would undoubtedly lose on the grouunds that so large a penalty is not reasonable.

Mr. Warren Partridge, of Springfield, thought that rates should be simply expressed. While the Wisconsin commission had come out in favor of the readiness-to-serve rate, he had observed that commissions usually concerned themselves most with the maximum rates, leaving discounts and lower rates to the companies. He thought that the important thing is for central stations to arrive at some system of rate-making which all can endorse, and thus be in a better position when rate legislation is proposed than if the companies could not agree among themselves.

Mr. E. L. Brown, of Elmwood, said regarding investment per kilowatt of equipment that the figure to his knowledge runs from $200 to $400. Mr. Baker thought the value given by Mr. Linn was very low. Mr. Linn said that he did not intend to cover more than one specific case. He had found among six plants in central Illinois a difference of 200 per cent in the cost of the plants. Mr. H. R. Kingman, of Mount Vernon, spoke in favor of companies uniting on a uniform method of determining rates, even though the exact figures of the different cities might vary to suit local conditions.

On motion of Mr. McAfee, of Galesburg, it was voted to appoint a committee of five to make recommendations on a system of determining rates to report at the next convention. Mr. R. S. Wallace, superintendent of the Peoria Gas & Electric Company, is its chairman.

INTERIOR WIRING AND ILLUMINATION

A Holiday Wiring Warning.

A timely warning is sent out by the Chicago Board of Underwriters in relation to special holiday window displays of merchants. This letter is issued about the middle of November, and is of widespread application. Electrical men are particularly interested in it, because of the extensive use made of electric-light effects and occasionally of electric motors in Christmas show windows.

The underwriters point out that the use of Christmas greens, harvest specimens and other inflammable materials, such as scenery, cotton to represent snow, etc. (especially in connection with electric or other lighting systems), is an increase to the fire hazard. Continuing, the letter says:

"The most rigid safeguards against fire should be used in connection with any special displays and additional fire protection provided in the immediate vicinity. Electrical wiring and apparatus used in this connection should be as well installed as if it were to be permanent and should be carefully inspected by one familiar with the subject before the current is allowed to be turned on. We would call particular attention to the fact that the use of flexible cord and flexible cord miniature Christmas-tree outfits is not approved for show-window decorations or interior decorations in mercantile risks. The custom of wrapping incandescent electric lamp globes with cotton, cheese-cloth, etc., or even of allowing inflammable materials of this kind in close proximity to such lamps, is extremely dangerous and should be discouraged. Special watchmen or firemen should be detailed to watch places where these displays are installed, not only to prevent spread of fire, but to avoid panics, which are almost sure to result from any fire starting where a considerable number of people are gathered together."

The State Street merchants of Chicago take pains to comply with the requirements of the fire underwriters and the city electrical inspectors in making their Christmas window displays, and fires are almost unknown. This is the time, however, when attention should be directed to the subject, so that electrical contractors and others may exercise all due diligence.

Compulsory Use of Iron Conduit in Winnipeg.

An ordinance, which becomes effective on Jan. 1, has been passed by the Municipal Council of the City of Winnipeg, Can., requiring the use of iron conduit in all kinds of electrical wiring in buildings within a defined central area, excepting dwelling houses and private barns. The regulation also applies to certain buildings outside of this proscribed area, such as churches, schools, public halls, etc. The ordinance stipulates that no building situated within the boundaries of the underground-wiring district for the city of Winnipeg shall be wired for electricity, used for any purpose whatsoever, unless the conductors are enclosed throughout in approved metal conduit or consist of approved armored cables, or in the case of exposed-surface work on walls or ceilings, are enclosed in approved metal conduit or metal molding. This rule does not, however, apply to frame or brick dwelling houses or private barns in the underground-wiring district.

All the buildings having basements and situated within the underground-wiring area must have all main electric feeders so arranged that connection can be readily made between them and the service wires that they may enter such basements. The feeders must run in the basement to the front or rear wall, whichever is selected as the most suitable point for the service entrance. From the basement the conduit must extend in a vertical direction to a suitable point above the ground and termi-

nate in an approved service cap. The conduit mains may be carried either on the exterior surface of the walls or be concealed. In the latter instance the main line cut-out and switch must be placed as close as possible to the point of entrance of service, but not higher than 8 ft. from the floor. In the former case the main line cut-out and switch must be placed at the point where the conduit is brought through the exterior wall into the basement. In either case the cut-out and switch are to be enclosed in an approved iron cabinet. Where minor additions or alterations to existing systems are contemplated, the City Council intimates that modifications may be permitted.

All churches, schools or colleges seating over 100 persons, all apartment buildings, all public halls, lodge rooms or dance halls, all wood-working shops or factories, or factories or buildings where especially inflammable goods are handled or stored, all packing houses and abattoirs outside of the underground wiring district must conform to the regulations also. In the wiring of basements of all buildings other than dwelling houses or private barns iron conduit is compulsory.

Discussion of Factory Lighting.

The Chicago Section of the Illuminating Engineering Society met for luncheon at the Great Northern Hotel at noon, Nov. 11, for the purpose of discussing the paper on "Factory Lighting," by Mr. L. B. Marks, presented at the recent annual convention of the society. Chairman Albert Scheible presided.

Mr. J. E. Moore, of the Western Electric Company, in the discussion, first gave some figures obtained from tests made in the factory of that company. He said that they prefer a general illumination sufficient for most operations which are conducted in a department, supplemented occasionally with individual lamps where some special illumination is needed. He gave figures from one department in which 40-watt tungsten lamps with Holophane reflectors are studded over the ceiling a distance of 9 ft. 8 in. above the floor, spaced about 7 ft. 10 in. apart. The watts per square foot are 0.68. The foot-candles vary from 3 immediately under the units to 2.1 midway between four of them. With this intensity of illumination most of the work in the department can be done, although some individual lamps are needed. He also gave some figures from the coil-winding department, where the requirements of illumination are fairly exacting. In this department a measured illumination of from 2.1 foot-candles to 1.3 foot-candles has been found sufficient. He said that no trouble had been experienced from the breakage of tungsten lamps due to the vibration of the building, although no special precautions are taken to protect them from jar.

Mr. J. R. Hubbard, of Cleveland, of the Adams-Bagnall Company, was called on to give some facts about the use of flame-arc lamps in factories and foundries with high ceilings. He said that recently flame-arc lamps had been brought out in this country which will operate from 70 hours to 100 hours on one trimming, which places the flame-arc more in accordance with American ideas of maintenance cost than formerly. As an interesting fact he mentioned that the Jones & Laughlin Company, at Pittsburgh, has some flame-arc lamps installed 78 ft. above the floor in a certain building.

Mr. George C. Keech emphasized the point made by Mr. Marks in his paper regarding the interference with clear vision caused by the reflection of light from bright parts of the work to the workmen's eyes. A great deal of trouble from artificial illumination may be traced to this reflection, which detracts so seriously from the ability to see clearly, and sometimes gives rise to a complaint of insufficient light when really there is too much.

Mr. L. G. Shepard, describing some of the general lighting with tungsten lamps in the Federal Electric Company's factory, noted that no trouble had been experienced from breakage of these lamps due to vibration, even where placed on rigid fixtures under floors where heavy stock is being unloaded.

Mr. J. R. Cravath agreed with Mr. Marks in the condemnation of factory lighting altogether by individual lamps placed over the work. He said that plenty of general illumination is always desirable, and in some cases the general illumination may be made sufficient for all purposes. However, many cases arise where individual lamps are absolutely necessary. In such cases they should be properly shaded, fitted with heavy reinforced cord, shade holders which will hold the reflectors firmly, and devices for the quick adjustment of the height of the lamp that will not be misused and take up the valuable time of the workmen.

The recent meeting held under the auspices of the electric power company at Grand Rapids, to which the factory managers and superintendents were invited, and the discussion of the same paper by Marks on "Factory Lighting" is a gratifying indication that this much-neglected subject is being vigorously taken up. Regarding the Grand Rapids banquet, the attendance and interest on the part of the factory superintendents at Grand Rapids shows that they are not indifferent to the subject. Incidentally, such meetings as this offer excellent opportunities for electric power company representatives to get acquainted with the factory managers with whom they must expect to have dealings on the electric power question.

The lighting of different kinds of factories calls for great differences in treatment. Some general illumination can be provided which will do away with a multiplicity of individual lamps and the nuisance and expense of many drop cords. In some cases the individual lamp and drop cord are absolutely necessary. There is, however, no excuse in any event for the old practice of hanging rows of bare lamps on drop cords about on a level with the workmen's eyes without any shading whatsoever. There should be, first, in any event, plenty of general illumination. Then if it is not possible to do good work without additional light, special illumination by individual lamps may be provided, but in such cases many of the former objections to special illumination disappear. In a factory lighted altogether by individual lamps, all of which are shaded, there is not the glare from the lamps in the eyes of the operators, but conditions are still very bad, because of the intense light in some places and the general surrounding darkness. The reflection or glisten of the work if bright metal or white-paper surfaces are being worked, are almost as trying as the bare lamp in some cases. The remedy for this is more general illumination from lamps placed high and some distance from the work and less special illumination from lamps hung close to the work. It is gratifying to note that this element of reflection from the work is being more generally recognized as a source of trouble with artificial illumination. Doubtless some cases of complaint of insufficient light are really due to inability to see, because of too much light being thrown on the work from some particular angle, which causes reflection into the eye of the worker from the objects upon which he is working. With diffused illumination, as from daylight, there is little of this trouble. It becomes more pronounced the more localized the source of light. It is found in its most aggravated form with the single incandescent lamp placed a few inches from the part illuminated.

Insurance Men Instructed in Rules of Electrical Construction.

As the fifth in his course of lectures explaining the rules and regulations of the National Electrical Code, Mr. B. E. Blanchard, chief electrical inspector of the Chicago Board of Underwriters, addressed the Fire Insurance Club of Chicago on Nov. 9 on the subject, "Low-Potential Systems," with particular reference to show-window and display lighting. Mr. Thomas Cooper, president of the club, presided, and there was an attentive audience of insurance men who listened carefully to Mr. Blanchard's lucid explanation of the requirements of the underwriters in the matter of electrical construction.

Mr. Blanchard exhibited a collection of antique electrical fittings made by Mr. Forsyth, of the Boston Board of Fire Underwriters, which were truly "horrible examples," often

amusing, representing the crude electrical wiring devices of perhaps a quarter of a century ago. These fuse blocks and switch bases, rosettes, etc., were mostly of wood, and Mr. Blanchard remarked that the carpenter had almost as much to do with electric interior wiring in those days as did the electrician. The contrast between these early attempts and the carefully protected apparatus of to-day shows in a marked degree the advancement of the electrical industry.

The speaker defined all potential systems as those having dynamo potentials of 600 volts and less. He explained the code rules in relation to these systems. Taking up first concealed and open wiring, he spoke of the difficulty of determining the condition of concealed wiring in buildings, and said that that was one of the chief difficulties the electrical inspector has to encounter. He gave a drawing showing the manner of protecting wires passing down sidewalls and through floors in open work. Wooden boxes afford the best means of giving this mechanical protection in damp places, while metal pipe should be used in all others. Referring particularly to open-work wiring, Mr. Blanchard described the various kinds of molding, and, referring to metal ceilings, which have lately come into extensive use, he said that they must not be made to conceal metal molding or wooden molding. The rules relating to conduit work were explained, and next the lecturer gave a drawing showing the essential features of a fixture canopy and also explained how these canopies are tested. A vapor-tight globe is required for incandescent lamps where inflammable gases are present, and a drawing of this fixture was given.

Sockets were next taken up, and the requirements in relation to these devices were gone over. Keyless sockets should be used wherever there are extra fire hazards from combustible dust in the atmosphere, as in grain elevators, for instance. Ceiling rosettes, lamp cord and wire guards for portable lamps were also considered. One interesting fact mentioned by the speaker was that in lighting installations only one service switch is required by the underwriters for the entire equipment; all others are placed for convenience. The construction of a typical arc lamp was illustrated by a diagram, and the speaker explained why in some lamps of the older construction it was necessary to require wire-gauze spark arresters.

As to show-window lighting, Mr. Blanchard made particular mention of the additional hazard due to temporary holiday installations at this season of the year, and he said that only thoroughly competent electrical men should be allowed to install holiday lighting. The merchant should employ someone of established reputation to do this work. He should see that the proper permit is obtained from the city Department of Electricity before the work is done, and after it is completed he should also see that city inspection is made. It is a good practice not to pay all of the amount called for by a contract of this nature until after final approval is obtained from the city inspectors. This subject is called to the attention of merchants and department-store managers about this time of year, and the larger establishments are careful to comply with the requirements of the city and underwriters' inspectors. For these holiday displays the use of flexible cord is not approved, and among other precautions care should be taken that tinsel be kept away from incandescent-lamp sockets.

One point made by the speaker, referring now to general conditions of wiring, is that when a fuse blows it should never be replaced without ascertaining the cause of the trouble. In lieu of an extended discussion, Mr. Blanchard explained the oddities of the loan collection of curiosities in the way of early electrical fittings.

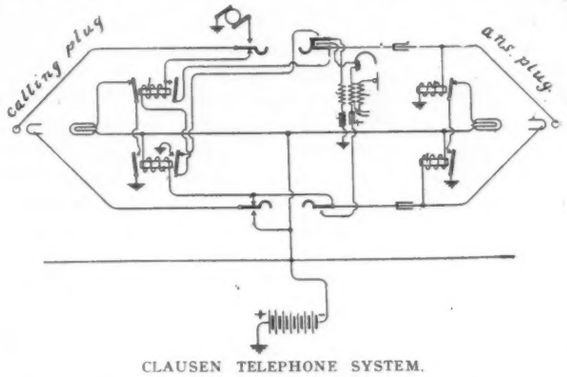
New Telephone Patents.

FOUR-PARTY SELECTIVE SYSTEM.

In four-party selective working many different systems of current supply have been suggested and used, but the combination selected by Mr. Klas Weman and recently patented by him is quite novel. He uses a very high-frequency current for two stations and a regular 16-cycle current for two stations. At each station a bridge is made across the line comprising a retardation coil, a condenser, a second condenser and the ringing or signaling device. This bridge is grounded between the two condensers. For the first station the signaling device is between the ground and one side of the line, and for the second station the signaling device is between ground and the other side of the line. For both these stations a high-frequency horn or "howler" is used. These respond to high-frequency current only and either may be selected at will by the application of high-frequency current on the proper side of the line. For the other two stations the same respective relations of station and line are maintained as for the first two; ordinary ringers are used, which respond to the 16-cycle current, but fail on the high-frequency.

BUSY-TEST SYSTEM.

Mr. H. P. Clausen, of Chicago, Ill., has patented an arrangement of central-energy cord circuit with special reference to the busy test. The circuit is shown below. It will be seen that the tip contact of the calling plug, with which the testing is



CLAUSEN TELEPHONE SYSTEM.

done, is connected to the contacts of two relays. The coils of these relays serve as the battery feed coils of the calling side of the circuit and their contacts also serve to control the supervisory circuit. These relays are not operated until the calling plug is inserted in the jack, at which time the testing circuit is not required. Tracing the testing circuit, we find it goes from the relays to the listening key and thence to the testing winding of the operator's induction coil.

REPEATER SYSTEM.

In connection with the introduction of the telephone repeater in commercial service, there arise special conditions due to the variation in the electrical constants of the various lines to be interconnected. One of these has been a sort of interference between the original and reinforcing currents due apparently to a difference in the phase of these two, introduced by the repeater. To overcome the difficulty it is suggested by Mr. H. E. Shreeve, of Wyoming, N. J., that the original current arriving at the repeater must not pass beyond the repeater, leaving the forward section of the line free for the reinforced current sent out by the repeater. He has devised circuits for carrying out this idea and has patented his system, the patent being assigned to the American Telephone & Telegraph Company.

SOUND MUFFLER.

A patent issued to Mr. C. J. Kintner, of New York City, and assigned to the Miniature Telephone Booth Company, describes a sound deadener and muffler. A felt-lined metal stand is provided upon which the telephone desk stand may be set with its transmitter mouthpiece within a conical enclosure, the bottom of which becomes sealed by the face of the transmitter. The other end has a hollow rubber ring adapted to seal up the front by flexible contact with the face of the user.

CIRCUIT-FINDER.

What might be called a circuit-finder has been patented by Mr. A. T. M. Thomson, of London, England. It is used to connect a single circuit to any one of a group of circuits which may need it. These latter are connected in suitable series to

a set of contacts arranged in a circle. A trailer connected to the single circuit is continuously driven over this through a clutch. An auxiliary device serves to stop the arm upon any set of contacts where connection is desired, the clutch giving way during the interim.

Letters to the Editor.

Some Errors in Testing Sources of Light.

To the Editor of Electrical World:

Sir:—By your comments on my letter in the Nov. 11 issue I judge that you imagine my appeal to be for the abandonment as useless of all scientific investigation that cannot be made to "gee" with practice—using the word "practice" in the narrowest sense. Nothing could be farther from the fact, for I conceive that there is a practical side to all so-called purely theoretical work. Perhaps this can be made clear by a concrete example.

In the mathematical investigation of finite surface light sources the exact expression for the intensity at any point under, say, a flat circular source may be found in two ways: (1) By direct integration of the algebraic expression for the intensity due to an infinitesimal element of the source, or, (2) by the use of zonal harmonics. By either method a result is obtained the actual numerical computation of which for any specific case is prohibitively clumsy and subject to great inaccuracy within wide limits due to the necessity of interpolating trigonometric functions to small decimals of a degree. If, in addition to this, the mathematical work is complicated by the idea of the volume of the source as effecting the distribution of the flux, the testing of the result by actual computation becomes almost impossible except for a few values. Such a result is useless and vitiated by its so-called correctness. Furthermore, the errors inherent in the experimental work, due to the impossibility of constructing a perfectly diffusing source, are of such a nature as to make their accurate determination out of the question, and they are of a magnitude much greater than the difference between the results of a rigorous mathematical analysis and the results of a less rigorous treatment of the problem. If, then, we are searching for practical means of studying finite surface sources, which method is of greatest value both to science and to engineering?

My "mathematical discursion" was perhaps an unsuccessful effort to show that your stricture of those who have attempted to investigate light sources mathematically was probably due to lack of knowledge of the difficulties inherent in the use of results obtained by a rigorous treatment of the problem, and to show that the use of less exact and less tedious methods, where nothing was to be gained by introducing complications, was sanctioned by the highest authority.

I was not aware that I had undertaken the amazing task of construing the attitude of either Heaviside or Maxwell on this question of rigor. Nothing could be more emphatic or require less construing than certain remarks made by Heaviside in Section 224 of the "Electro-Magnetic Theory." "To have to stop to formulate rigorous demonstrations," he says, "would put a stop to most physico-mathematical inquiries" and, quoting Lord Rayleigh, "the physicist may occasionally do well to rest content with arguments which are fairly satisfactory and conclusive from his point of view."

New York. Bassett Jones, Jr.

The Inventor and the Patent Situation.

To the Editor of Electrical World:

Sir:—Inventors are proverbially poor in earthly goods, while modern business corporations are proverbially unscrupulous in the ways and means of advancing their interests. Such corporations are in a position to employ experts, whose duty consists in making discoveries and inventions. These experts once in a while actually do make discoveries and inventions of some value to the arts, and most of the time believe that they do it. Modern corporations are also in a position to employ patent experts, who have gained a thorough knowledge of all the intricate technicalities and routine of the United States Patent Office practice, frequently from serving there as assistant examiners. It is the express duty of these patent attorneys to monopolize by letters patent the actual or imaginary inventions of the professional inventors employed by the corporations. Moreover, it is the duty of the patent experts to secure as many as possible "paper patents" calculated to block the way of future bona-fide inventions in order to avoid possible future competition in a special line of production.

Any invention of some importance in the arts is, therefore, certain to get into interference with the actual or alleged inventions of the servants of the corporations.

The man who finds himself in antagonistic relations to a powerful corporation, in consequence of an interference, finds, if he did not know it previously, the delusive nature of abstract equality before the law of all citizens of the Republic. Let us cite one instance.

The offices of the examiners of the Patent Office are legally open to all citizens. This seems to be fair on the surface. However, the average individual inventor is seldom in a position to avail himself of this privilege, if at all. At the same time the powerful corporations maintain a regular staff of patent attorneys, recruited from former employees of the Patent Office in one capacity or another. These able and willing representatives of the interests of corporations use the privilege of personal contact with the examiners whenever and wherever they see fit. Indeed, the examiners who could avoid being subtly influenced by such constant contact would have to be more than human. In order to insure impartiality of judgment all communications with the Patent Office ought to be limited to written or printed documents.

Another point to be subjected to criticism is the excessive secrecy of the Patent Office.

The German or new English patent systems seem to be much more in the interest of the inventors and the public at large than the present American system.

Cleveland, Ohio. Isador Ladoff.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

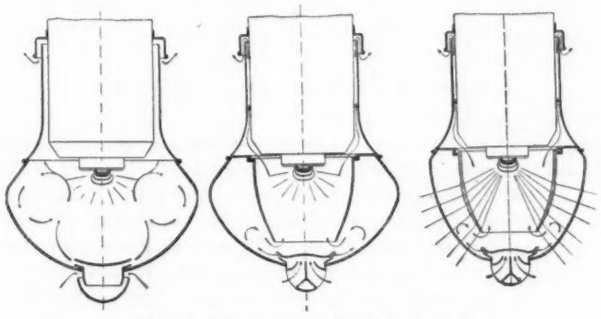
Generators, Motors and Transformers.

Burning Out of Oil Transformers.—G. Molnar.—Since the inflammation temperature of a good transformer oil is about 250 deg. C., and the oil temperature, even in warm rooms, is hardly liable to increase above 100 deg. C. under normal conditions, the danger of an inflammation of the oil is never great. The author describes, however, a peculiar case in which an oil transformer burned out several hours after operation had ceased. The transformer delivered energy to a factory and was connected up to the supply circuit of the municipal central station. At 6 o'clock in the evening the secondary circuit was disconnected. The primary of the transformer was not disconnected, but was protected by fuses according to existing regulations. At 10 o'clock the transformer was discovered to be on fire. The author shows that the only possible cause for the accident was a short-circuit of a few turns of a winding. If more than a few turns have been short-circuited, the primary current would probably have been large enough to cause the

fuses or automatic circuit-breaker to act. In spite of the fact that with a short-circuit of a few turns the current remains at a small value, the heat produced is sufficient to raise the temperature of the oil above the ignition point. Some speculations are added as to what might have caused the short-circuit of a few turns.—*Elek. und Masch.* (Vienna), Oct. 31.

Lamps and Lighting.

Flame-Arc Lamps.—P. HEYCK.—The first part of a paper read before the Dresden Electrical Society on new flame-arc lamps of Koerting and Mathiesen. It is well known that in the old flame-arc lamps there were evolved vapors which deposited on the inside of the globes, thereby decreasing its transparency and etching the glass so that after some 17 hours the candle-power of the lamp decreased by 30 per cent or 40 per cent. This result is attributable to a defective circulation of the air and vapors in the lamp. The old construction of the flame-arc lamps is shown in Fig. 1. The circulation of the air vapors is indicated by arrows, and it will be seen that the hot vapors come into contact with the cold surface of the globe, which results in the detrimental deposit. The new arrangement, which avoids this defect, is shown in Fig. 2. There are two globes used and the space between the inner and the outer globe is tightly closed at the upper end. It will be seen that when the air has become mixed with vapors from the impregnated carbon electrodes, it has no opportunity to come again in contact with the cold outer globe. The arrangement also insures that when the lamps are used in the open air, even with strong winds, the circulation of the air is from the bottom upward and not the other way; this fact has been established in 1½ years' practice. On account of this new construction the candle-power does not decrease. While formerly a lamp which



FIGS. 1, 2 AND 3.—FLAME-ARC LAMPS.

gave originally 2400 hefner cp would give only 1600 candles in a few weeks, the new lamp maintains continually its original candle-power of 2250 (this is less than the other older value because there is a loss of 7 per cent due to the inner globe). The attendance of the lamp is also simple, because there is almost no need of cleaning the globes. A further new development is due to the use of specially cut glass for the inner globe. The distribution of light from flame-arc lamps with inclined electrodes side by side has the disadvantage that the maximum is at an angle of 60 deg. below the horizontal, so that the illumination of the floor is non-uniform. This disadvantage has been overcome by using the "dioptric" globe (a globe in which are cast prismatic rings) for the inner globe, as shown in Fig. 3. There is no refraction of light rays in the upper part of the globe, while in the lower parts of the globe the light rays are deflected upward. The result is indicated in Fig. 4, which shows in curve *a* the distribution of light with an old Excello lamp and in curve *b* the distribution of light with the new dioptric lamp. The degree of uniformity of illumination of the streets has been greatly improved thereby. Some figures are given of volts, amperes, watts and hefner candles of direct-current flame-arc lamps. For an Excello lamp with inclined electrodes side by side the specific consumption for yellow light varies between 0.24 watt and 0.17 watt per mean hemispherical candle-power. For white light it varies between 0.32 and 0.22. The watts given are the total watts of the circuit divided by the number of lamps. The specific consumption includes the loss in the series resistance. The candle-power is measured with clear globes in hefner candles. The Excello lamp is built both for direct current and alternating current. For the alternating-current series lamp there is employed a new arrangement, shown in Fig. 5. Formerly series alternating-current lamps were mostly used in shunt with an inductance

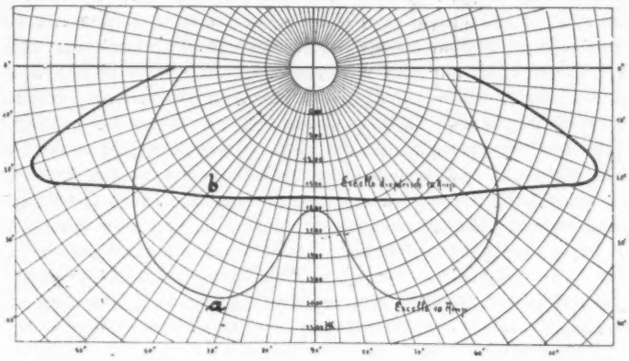


FIG. 4.—PHOTOMETRIC CURVES OF FLAME-ARC LAMPS.

coil, through which a current of 0.5 amp or 1 amp was continually passing. When the electrodes of the lamp were consumed the inductance coil would carry the whole current, but this would cause a distinct change in the electrical conditions of the circuit. When about one-half of the lamps of a circuit were extinguished, all the other lamps (which had already carried much less than the normal current) would be extinguished. In the new arrangement, as shown in Fig. 5, *h* is the magnet in the main circuit and *n* the magnet in the shunt circuit. The oscillating armature is placed between the two. Above the armature there is an iron core *k* with two windings. At *s* is a contact, which is either closed or open. When the lamp is lighted the current passes from terminal *a* through *k*, one electrode, the arc, and the other electrode to the terminal *f*. A shunt circuit connects the terminal *a* through *n* and *de* with the other terminal *f*. When the voltage of the lamp rises to a certain value above normal, the shunt magnet *n* attracts the armature and the contact *s* is closed, thereby closing a second circuit, *a, b, c, s, f*, for the main current, so that the arc is extinguished. The main current which now passes through the winding *bc* magnetizes the core *k*, the apparatus becomes a transformer and produces at its secondary terminals *be* a voltage which is higher than was the voltage *af* at the lamp terminals. This voltage *de* is impressed on the magnet core *n* so

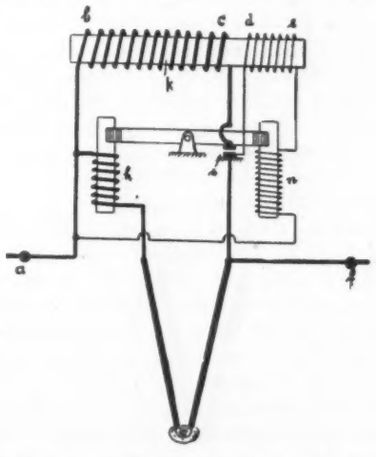
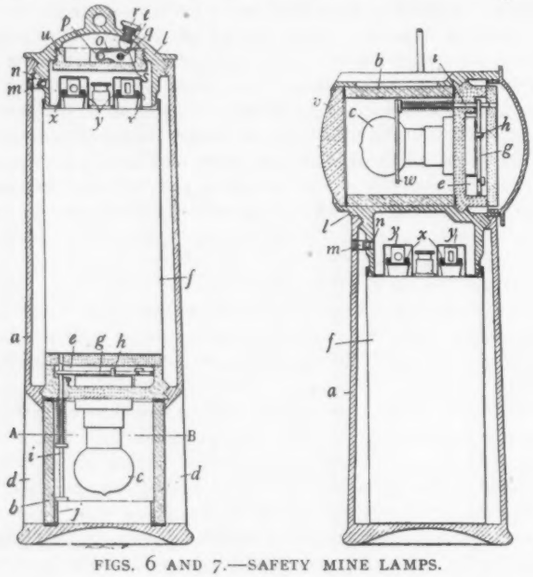


FIG. 5.—ARRANGEMENT OF ALTERNATING-CURRENT SERIES LAMP.

that the latter attracts the armature with great force and closes the contact *s* tightly. The voltage *bc* is thus substituted for the lamp voltage. This arrangement has the following advantages: The whole mechanism is placed within the lamp and is so simple that the appearance of the lamp is just like that of an ordinary lamp. The inductance coil is disconnected while the

lamp is burning. All of the lamps of a circuit except one can be extinguished without changing the electric conditions of the circuit. The inductance coil consumes only 40 watts, while the burning lamp consumes from 300 watts to 600 watts. The paper is to be concluded.—*Elek. Zeit.*, Nov. 5,

Safety Lamps in Mines.—A description of a new electric safety lamp devised by C. V. Ely and T. P. Brady. A cylindrical case of iron, brass or aluminum is extended at one end in the form of a stout glass cylinder enclosed by metal bars and a cap formed in one part with the case. As shown in Fig. 6, a small metallic-filament lamp is mounted on a disk which forms part of a porcelain box *e* containing an automatic cut-out. This box is screwed into the end of the case just below a secondary cell. The cut-out consists of a spring-controlled switch *g*, kept closed by a vertical sliding rod *i*, which is held in position either by a thin ring of glass *j* in the lamp chamber or by a metal ring *w*, placed over the lamp bulbs, as shown in Fig. 7. This rod is controlled by a spring, and if the main glass-enclosing cylinder *b* is broken, the thin ring also breaks and the switch is opened. In the case where the rod bears on a ring on the lamp bulb, the breakage of the lamp releases the cut-out. In the construction shown in Fig. 6 the upper part of the case is provided with a screwed cover *l* which is secured



FIGS. 6 AND 7.—SAFETY MINE LAMPS.

in position by a concealed spring catch *m* in the interior of the case. This catch can be released only by means of a magnet or a special key. The cover is hollow, and contains a spring contact switch operated from the outside by means of a close-fitting thumb-screw *r*. The chamber in the cover is made gas-tight by means of rubber washers *t* on each side of the thumb-screw. Plugs and sockets of a special design are provided for charging the cell, and a fuse is enclosed in one of the plugs.—Lond. *Elec. Eng'ing*, Nov. 4

Metallic-Filament Joint.—A note on a recent British patent (20,915, 1908; Oct. 28, 1909) granted to T. McKenna (Glühlampenwerk Anker-Ges.). A coating of the metal, of which the leading-in or supporting wire consists, is electrolytically deposited on the end of the filament. Fusion of the filaments to the wires is then effected in a blow-pipe flame without oxidation of the filaments and a good conducting joint is obtained.—Lond. *Elec. Eng'ing*, Nov. 4.

Electric Gas Igniters.—Wendt.—An illustrated description of the most common systems for igniting or extinguishing gas lamps from a distance by electrical means. The author thinks that on account of their convenience and greater protection against fire electric igniters should be introduced on a larger scale.—*Elek. Zeit.*, Nov. 5.

Generation, Transmission and Distribution.

Reversing Rolling Mills.—C. A. Ablett.—A paper read before the Institution of Engineers and Ship-Builders in Scotland on electrically driven reversing rolling mills. The author described the working of the Ilgner system with flywheel converter, and gave some particulars of the latest forms of rolling-mill motors with forced ventilation. He explained also the control and safety devices employed. It was mentioned that the flywheel sets could be driven directly by steam turbines, and the use of exhaust-steam turbines for such work was suggested. —Lond. *Elec. Eng'ing*, Nov. 4.

Boiler-House Losses.—O. L. Peard.—The writer describes the various fuel losses occurring in daily practice, and deals with the facilities for their detection, allocation and reduction. To increase as much as possible the over-all efficiency it is necessary to investigate the losses taking place, which lie chiefly in heat radiation, flue-gas thermal losses, combustible in ash and clinker rejected.—Lond. *Electrician*, Nov. 5.

Traction.

Single-Phase Traction in Germany.—W. Wechmann.—A continuation of his illustrated article on single-phase traction on the Blankenese-Ohlsdorf-Hamburg Road. In the present instalment the author concludes the description of the new motor-cars. The total weight of each car is 61 tons. The complete electrical equipment of each car weighs 12.5 tons, of which 6.6 is the weight of the motors with gearing; 2.4 that of the main transformers, and 3.5 that of the balance of the electrical equipment.—*Elek. Zeit.*, Nov. 5.

Single-Phase Traction in Holland.—The first part of an illustrated description of the single-phase railway between Rotterdam, The Hague and Scheveningen. The length of double line is 20 miles and of single line, including that in the stations, about 47.5 miles. The three-phase currents are generated in the power station and are changed to two-phase currents at 10,000 volts. The line is divided into two parts, corresponding to two phases. The article is to be concluded.—Lond. *Electrician*, Nov. 5.

Installations, Systems and Appliances.

Association of Austrian Central Stations: Oil as Fuel.—The sixth general convention of the Association of Austrian and Hungarian Central Stations was held from Sept. 26 to 29 in Meran. In view of the rapidly increasing price of coal in Austria, the general subject of discussion was the possibility of using oil as fuel. Sauer reported on extended experiments made at the Vienna municipal central station with oil firing of boilers. While definite results have not yet been obtained, the thermal efficiency is between 72 per cent and 74 per cent. More, the cost for attendance is low, since one fireman can attend to six boilers; the nozzles remain stationary and the attendant has only to regulate a valve. It depends on his skill to maintain a bright flame and to assure smokeless consumption. The chief trouble with oil is due to the rigid official regulations requiring the bringing of the oil to the central station and storing it. Engelmann reported on the use of Diesel engines in various central stations. Detailed experiments have been made at St. Pölten with two 800-hp, four-cylinder Diesel engines. At full-load the consumption of 185 grams of oil per hp-hour has been guaranteed; this figure, or even less, has been obtained in practice. At three-quarter load the crude oil consumption was 290 grams per kw-hour. Tests by Ross of two 300-hp Diesel engines and one 500-hp Diesel engine showed a consumption of 266.4 grams of crude oil per kw-hour at full-load, 275.2 grams at three-quarter load and 312.8 grams at half-load (453 grams = 1 lb.). Results from Diesel engines in other stations are also given. In summing up, their disadvantages are said to be the small overload range and the necessity of very careful attendance. The advantages are their high economy and ease of starting quickly. For this reason they are especially useful as reserve machines in stations of medium size. Diesel engines up to 400 hp give excellent results, especially if care is taken in attendance, lubrication and cooling. The saving compared with steam power is quite considerable and amounts in the stations mentioned in the report to from 30 per cent to 55 per cent. Concerning Diesel engines of larger size no definite conclusions can yet be stated, since there is not yet sufficient experience with

such engines in commercial operation over a long time. The storing of the oil requires much less space than that of coal, and the oil can be stored at any distance from the engine. Loaker reported on the possibilities of developing water-powers in Austria. Several reports were submitted concerning the calibration of electricity meters, electric regulations and accident insurance. The large water-power stations in the neighborhood were visited.—*Elek. und Masch.* (Vienna), Oct. 24.

Electricity Supply in England.—W. M. ROGERSON.—His inaugural address to the Leeds Section of the (British) Inst. Elec. Eng. The author gives a short restrospect of the supply of electrical energy for lamps, motors and railway, comparing the present position with that in the early days. Ten years ago there were in Great Britain 93 municipal and 70 private electric supply undertakings; at the end of 1908 the respective numbers were 338 and 203. Taking six typical generating stations, the average cost in cents per kw-hour sold in 1908 was: Coal, 0.92; oil, wages, repairs, etc., 1.40; works costs, 2.32; total costs, exclusive of interest and sinking fund, 3.70; while the average costs in the same generating stations to-day are: coal, 0.52; oil, waste, repairs, etc., 0.60; works costs, 1.12; total costs, exclusive of interest and sinking fund, 1.56, or roughly, each kw-hour sold in 1898 cost over 3.5 cents to produce, while to-day the cost has almost come down to 1.5 cent. Notes are also given on engines, electrical machinery, switchgear, storage batteries, mains, meters and railway apparatus.—Lond. *Electrician,* Nov. 5.

Glasgow.—An account of last year's financial report of the municipal central station of Glasgow. Reduction in the charges for energy, the extensive use of metallic-filament lamps, and the general trade depression are responsible for a deficit of $17,725, the revenue showing a decrease of $38,645 compared with the income recorded a year ago; but in spite of an increased output the working expenses show a reduction of $52,075. The quantity of electricity sold to private consumers during the year ending May 31 last was 32,736,058 kw-hours, compared with 31,087,322 kw-hours during the previous year, being an increase of 5.34 per cent. Public lamps required 1,555,150 kw-hours and 173,703 kw-hours were sold by contract, making the total quantity of electricity sold 34,464,911 kw-hours, an increase of 1,670,104 kw-hours compared with the previous year. The load factor has increased, being now 18.35 per cent. The generating cost per kw-hour sold was 0.84 cent, the distribution cost 0.16 cent, the management cost 0.14 cent, the total cost, excluding capital charges, 1.46, and the total cost, including capital charges (interest and sinking fund) 2.72 cent. The depreciation was 0.74 cent. Since the total receipts were 3.42 cents, there was a deficit of 0.04 cent per kw-hour sold.—Lond. *Electrician,* Nov. 5.

Synchronizing.—J. TEICHMÜLLER.—An article illustrated by diagrams. For alternating-current plants containing more than two machines the problem of devising connections for synchronizing can be solved in many ways. Since many solutions are dangerous and others are inferior, the author gives a systematic review and describes a standard method for the simplest case.—*Elek. Zeit.,* Nov. 5.

Electric Equipment of Tunnel.—E. G. MEYER.—An illustrated description of the equipment of the new tunnel under the Elbe River, in Hamburg, connecting St. Pauli with Steinwärder, for passenger and freight transportation. It is a tube road with elevators at both ends. Under the supposition that each trip takes about two or three minutes, it is estimated that at times of greatest traffic from 6000 to 7000 passengers can be carried over in half an hour. The author describes especially the equipment of the elevators.—*Elek. Zeit.,* Oct. 28.

Wires, Wiring and Conduits.

System of Wiring.—An account of recent developments in the "O. S." system of wiring. Three separate systems are involved under the name of "O. S.," the first of which, the "Kuhlos," has had some vogue in Continental Europe and consists of a plain brass or copper sheet wrapped round ordinary rubber-insulated conductors, while the second system, the "Stannos," is in principle also the same, though tinned copper is used as a covering and is lapped twice round the cable and rendered watertight by a special process. Both of these systems, when erected, are continuous throughout; to allow for this fact numerous special fittings were designed. The third system is the "Kalkos" conduits. The new developments of this system refer to various fittings and accessories.—Lond. *Electrician,* Oct. 29.

Magnetic Properties of Enameled Wire.—R. GANS.—"Enamel wire" (copper with a layer of enamel) as made by a German company, has the two advantages that the space is better utilized and that the wire can be used with a higher current density than if cotton or silk is used for insulation. The author shows that it is also very useful for magnetic experiments in which the utmost utilization of the space is important. Such wire has a magnetic susceptibility of less than 0.0000295. Even for precision measurements the wire may be considered to be non-magnetic.—*Elek. Zeit.,* Nov. 5.

Calculation of Transmission Lines.—A. BLONDEL AND C. LE-ROY.—A continuation of their serial. In the present installment they give a second example of the application of their method. It relates to an underground transmission line of 100 km (60 miles) length at 10,000 volts with a frequency of 50 cycles.—*La Lumière Elec.,* Oct. 30.

Municipal Wiring.—An article on the pros and cons of the hiring out of apparatus and the wiring of installations by municipal supply stations in competition with private enterprise. The opinions of 19 British municipal central-station engineers are given. The great majority of supply engineers are in favor of hiring out apparatus and of working in conjunction with contractors in preference to municipal wiring. The subject is also discussed in an editorial.—Lond. *Electrician,* Oct 29.

Electrophysics and Magnetism.

Alternating-Current Spark Potentials.—J. DEKOWALSKI AND U. J. RAPPEL.—A paper in which the authors define first a method intended to give as high an accuracy as possible for determining alternating-current spark potentials. The measurements obtained are utilized to examine more closely the theory of the relation between spark potentials and the radius of curvature of the electrodes. Previously it was commonly accepted that the spark would jump when the maximum electric intensity between the electrodes had passed certain definite limits. Since this theory failed to explain all observed facts, A. Russell has added an hypothesis of his own. He assumes that for explosive distances greater than 0.1 cm a certain value is to be deducted, in the determination of the maximum stress, which he terms "lost volts." For air he assumes this value to be 800 volts. The results of the present authors, however, show that the claims of Russell are not justified regarding the constancy of the maximum stress. The results show rather a certain regularity, and for a definite explosive distance a minimum seems to exist. The theory of Russell is, therefore, not a satisfactory explanation of the relations.—*Phil. Magazine,* November.

Crystal Rectifiers.—A. E. FLOWERS.—G. W. Pierce has formally investigated a number of rectifiers, consisting of points resting on crystals. The crystals were anastase, brookite and molybdenite. Of these the molybdenite was by far the most sensitive and possessed the largest current-carrying capacity. The present author has made a further research for a rectifier of large capacity and thinks that galena crystals are the most promising. He uses them in contact with a copper point. The volt-ampere characteristics curves determined show a distinct point at which breakdown occurs. The point occurs at a fairly definite current for any given set of conditions of setting. In general, however, each crystal and each setting will have its own breakdown point. This point may be 15 or more volts with from 30 to 40 milliamperes flowing from point to crystal on fresh rectifying spots and may be as low as 5 volts and 90 milliamperes after several breakdowns. In general, the higher breakdown voltages are reached when the current is small. The material of the point, whether copper, steel, platinum, etc.,

does not seem to matter, nor does the shape of the point or the ratio of contact areas. The chief results are summed up as follows: The rectifying action is produced at the surface, or, in a surface film, and is not due to the point employed. The rectification is not an effect of the sharpness of the point or the ratio of contact areas. The rectifying film will break down at a moderate e.m.f. (6 to 15 volts), which is higher the smaller the current. The rectifying film can be destroyed by the action of the electric current. The feeble evanescent e.m.f. existing after the passage of current in either direction through the rectifier is insufficient to account for the rectification, and its direction is opposite to that which would be required for rectification. There is apparently no difficulty in rectifying currents of very high frequency. The rectification disappears at high temperature—that is, about 270 deg. C., but is partially regained on cooling. The rectifying film can be produced artificially by electrochemical treatment with amorphous sulphur. The rectification is probably due to the electrochemical formation of a resisting film at each reversal.—*Phys. Review,* November.

Crystal Rectifiers.—G. W. Pierce.—A third paper of the author on this subject. In his former work he had obtained the best results with molybdenite in contact with copper. He now finds that iron pyrites in contact with copper are even more effective. He concludes that the rectifying action does not take place through the intermediation of thermoelectricity, but rectification and thermoelectricity may have a common basis. "For example, if we suppose that the surface of separation of two conductors has such a character as to permit the passage of electrons more easily in one direction than in the opposite direction, the boundary will act as a rectifier for alternating currents; it will also give rise to a thermo-electromotive force when heat is applied to the boundary, provided the velocity of the electrons is increased with an increase of temperature."—*Phys. Review,* November.

Musical Arc Oscillation in Coupled Circuits.—E. T. Jones and M. Owen.—If the primary of a pair of coupled circuits, in series with a condenser, forms the shunt to a Duddell musical arc, and if the secondary coil is connected to another condenser, either of two notes may under certain circumstances be heard. The frequencies of the electrical oscillations in the circuits corresponding to the two notes are generally much lower than those calculated for the circuits from the inductances of the coils and the capacities of the condensers, the resistances being neglected. In the present paper the influence of the resistances of the circuits is considered. It is found that the great differences between the observed frequencies of the electrical oscillations in coupled circuits produced by the musical arc and the values calculated from the inductances of the coils and the capacities of the condensers, cannot be accounted for merely by allowing for the resistances of the circuits. The principal cause of the difference is the fact that the arc behaves as if it has self-inductance, which is constant during any particular train of oscillations (though different under different circumstances) and which must be taken into account in calculating the frequencies. Any one of the harmonics of the arc-note up to the sixth can be strongly reinforced by suitably adjusting the ratio of the two frequencies of the system. If the two notes of the arc are equally stable, and if the interval between them is a perfect fifth, a third note may be heard, which corresponds to an electrical oscillation of frequency equal to the difference of the frequencies of the two primes.—*Phil. Magazine,* November.

Multiple Atomic Disintegration.—F. Soddy.—A paper advancing a new suggestion in radio-active theory. The conclusion seems inevitable that the cause of disintegration is apart from the atom. It is difficult to believe that the cause is resident in space external to the atom. It seems more probable that it exists within the atom and at the same time is uninfluenced by it. The author investigates whether necessarily only one mode of instability can exist within the atom at one time. He suggests that multiple modes of disintegration may be proceeding simultaneously and independently within the same atom. There is nothing in this idea opposed to all that is known of the character of atomic disintegration. On the other hand, it is shown that such disintegrations would simulate closely in many respects simple disintegration.—*Phil. Magazine,* November.

Units, Measurements and Instruments.

Measurement of Mechanical Pressure by Electrical Means.—A Lafay.—An account of a paper read before the French Academy of Sciences. The author measures high mechanical pressures by the change of resistivity which electric conductors subjected to the pressure undergo. The following two formulas are given for platinum and for mercury. For pure platinum in the form of a wire of 0.03 mm, the relation is

$$\frac{r - r_0}{r_0} = -1.86 \times 10^{-6} p$$

where r is the resistance and p the pressure in atmospheres. For mercury at a temperature of 15 deg. the pressure p is given by the formula

$$\frac{r - r_0}{r_0} = -32.7 \times 10^{-6} p + 1.1 \times 10^{-9} p^2,$$

the pressure being measured in this case in kilograms per square centimeter.—*La Lumière Elec.,* Oct. 23.

Electromagnets.—A. Berninger and R. Edler.—For the correct design of electromagnets as used in modern apparatus, switches, etc., it is of importance to determine the effect of the Joulean heat produced in the magnet winding upon the operation of the electromagnet, and secondly the relation between the number of amp-turns, the size of the air-gap and the tractive force. In the present installment the authors discuss the effect of the heat of the magnet coils and give the results of their theory in tables and diagrams. The paper is to be concluded.—*Elek. und Masch.* (Vienna), Oct. 31.

Demonstration Apparatus.—R. van Canwenberghe.—An illustrated description of an apparatus for demonstrating alternating-current phenomena and electromagnetic oscillations in the lecture-room.—*Elek. Zeit.,* Oct. 28.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—von Lepel.—An illustrated article on the Lepel system which is used by the British army. The generator for the production of electrical oscillations consists of two electrodes between which an electric discharge takes place, and with which one or more oscillating circuits are connected in parallel. The working surfaces of both electrodes, of which the negative must be metallic, are parallel to one another and are separated by a gap which is small in comparison with their area. The parallelism of the electrodes renders it possible for the discharge which takes place between them to wander over

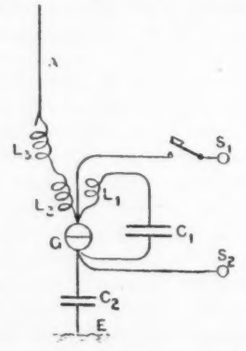


FIG. 8.—DIAGRAM OF WIRELESS TRANSMITTER.

their surfaces without suffering any alteration in length, while the distance between them must be so small—only a fraction of a millimeter—that the heat caused by the discharge is quickly carried away. The voltage on such a generator is, therefore, limited. The two electrodes are separated by a flat ring of solid insulating material (paper) having a hole in the center so as to prevent the discharge from reaching the edges of the plates. It is advantageous to have the materials

of the electrodes different for direct current and the same for alternating current. Thus, for alternating current, pure electrolytic copper may be used for both electrodes, while for direct current it is better to have the positive of copper and the negative, particularly for e.m.fs. below 500 volts, of a specially dense bronze. In order to carry away the heat produced the electrodes are either made hollow and cooled by means of liquid circulating through them, or provided with cooling flanges exposing a large surface to the air. Fig. 8 is the diagram of the usual connections of the transmitting circuits. A is the aerial wire, G the generator, C_1 C_2 capacities, L_1 L_2 coupled inductances, I_3 aerial inductance, S_1 S_2 supply terminals. The current in C_1, L_1 and G has usually the same frequency as that in A, L_2, L_3, G and E.—Lond. *Electrician*, Nov. 5.

Measuring Wave-Lengths.—A. CAMPBELL.—An account of an investigation carried out in the (British) National Physical Laboratory on the measurement of wave-length for high-frequency oscillations as used in wireless telegraphy. The author describes two wave-meters and gives the results of tests. It appears that within the limits of wave-length used, a wave-meter with coils of well-stranded wire gave results in close agreement with theory, while in the case of an instrument with coils of solid wire the agreement was as close as could be expected, as the correcting formulas are only strictly applicable to long solenoids.—*Phil. Magazine*, November.

Automatic Telephone Exchange.—A. KRUCKOW.—An illustrated description of the first small automatic telephone exchange in Germany, which connects a small agricultural district automatically with the next long-distance line. The system is essentially that of Strowger, with some modifications of Siemens & Halske.—*Elek. Zeit.*, Oct. 28.

Wireless Telegraphy for Air-Ships.—K. SOLFF.—An illustrated article on wireless telegraphy between the earth and air-ships. The author makes some suggestions on the arrangement of the aerial wire on Zeppelin's air-ships in order to decrease the danger of ignition and at the same time produce the most favorable electrical conditions.—*Elek. Zeit.*, Nov. 5.

Telegraphy in England.—Extracts from the annual report of the British Postmaster-General on wire and wireless telegraphy in Great Britain.—Lond. *Electrician*, Nov. 5.

Miscellaneous.

Graphical Analysis of Public Service Operations.—L. R. NASH.—The author strongly recommends the use of curves for the general study of operating accounts of large companies. The set of such curves should include figures of the company's earnings, operating expenses, and ratio of expenses to earnings. On account of the importance of proper maintenance in preserving the value of physical property, as contrasted with the transient value of other expenditures, the latter should be shown separately together with their ratio to earnings. This group of curves, which reflects general conditions, should be followed by an analysis of each month's expenses. Maintenance is first deducted, and the remainder divided into standard groups, which for a combined railway and lighting company are energy costs, operation of cars, distribution costs, and general expense. Each of these groups is further divided in turn into suitable component parts. Maintenance is separated into standard divisions, some of which are further analyzed to see that a sufficient amount of work has been done or that it has been done efficiently. Track maintenance is expressed in cost per mile of track per year and compared with a "bogey" by which is meant a carefully predetermined standard. Rolling-stock maintenance is shown in 12 months' perspective and also in monthly costs per car-mile under separate expense account. Power-station operation is shown in monthly unit costs of various separate expense accounts in addition to the 12 months' total. General expenses are not divided so completely, some items, such as rent and insurance, not being subject to fluctuations. Car operation is shown in part on a car-mileage basis. In connection with these curves certain physical data intimately related thereto are given, such as car-miles, power-station output, energy per car-mile, etc. Such a set of curves permits the quick location of operating irregularities, and the quick grasp of operating conditions gives leisure and stimulus for attacking vital problems of policy and expansion without which successful administration is impossible.—*Stone & Webster Pub. Serv. Jour.*, November.

Military Corps of Engineers.—An illustrated article on the work of the London Division of the Corps of Royal Electrical Engineers, describing competitive work recently carried out by the different companies.—Lond. *Electrician*, Nov. 5.

BOOK REVIEW.

DIE ENTWICKELUNG DER TELEGRAPHIE UND TELEPHONIE. By Richard Hennig. Leipzig: Johann Ambrosius Barth. 199 pages, 61 ills. Price, 4 marks.

This volume constitutes a member of the Barth *Wissen und Können* series of volumes. It is a historical review of the development of the arts of telegraphy and telephony up to the year 1879. That is to say, the book is a history of early telegraphic and telephonic development from the earliest times. Reference is made to the early optical and acoustical telegraphs of Greece, Rome and other ancient civilizations. The book will have great interest to the student of the history of electrotechnics.

NEW APPARATUS AND APPLIANCES

Continuous Blue-Print Machines Equipped with Cooper Hewitt Lamps.

BY DR. JOSEPH C. POLE.

As a cheap and convenient way of copying drawings, the method of blue-printing has always been of very valuable assistance to the engineer; its development, however, has not always kept in line with the growth of engineering. Only recently, chiefly in the United States, and there principally forced by the high cost of labor, more attention has been paid to blue-printing apparatus, which within a comparatively short time have advanced to a high degree of efficiency. Lately, others besides engineering trades have taken up this convenient method of reproduction and now there are already many concerns which are using it for copying office records that are changed daily and that have to be made in large quantities.

The need for an increase in copying speed and for independence of daylight and weather naturally led to the use of artificial light, and the mercury-vapor lamp in a short time occupied an important place and also influenced the construction of blue-print apparatus.

The mercury-vapor lamp transforms a very high percentage of the power consumed into actinic radiation and for photographic purposes is more economical than any other known source of light. Another advantage is its long life, thus doing away with operating expenses, and, furthermore, it can be handled by unskilled workmen if the construction of the machine itself is sufficiently simple. As the efficiency of transformation of electrical energy into light in the mercury arc is very high, the production of heat is a minimum, so that the paper may be brought quite near the lamp, thereby obtaining a compact construction with concentrated light effect, and still excluding the danger of paper or celluloid being set on fire

as with arc lamps. The long light column of the mercury-vapor tube, being adaptable to any paper width and being of uniform surface intensity, represents, when in a rotary blue-print machine, a source of light which, as to equality, can compete with diffused daylight. Because of the even illumination the

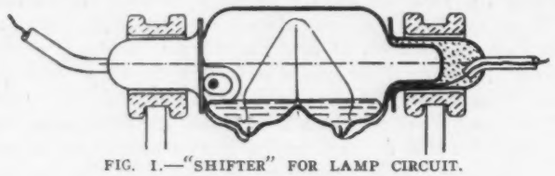


FIG. 1.—"SHIFTER" FOR LAMP CIRCUIT.

copying process need not be watched; it is sufficient to work with ordinary copying frames according to a certain set time or with automatic printing machines after having once determined the proper speed according to the transparency of the tracing and the sensitiveness of the paper.

Of the contrivances developed for blue-printing with Cooper Hewitt lamps the continuous blue-print machines are especially worthy of notice. Two different principles of construction are employed. In the first the lamps are placed inside of a glass cylinder which rotates on its axis and, by means of belts, carries along the tracing and paper pressed on from the outside. In the second kind, the glass cover surrounding the lamps is stationary and merely serves as a guide as the paper passes (and need not, therefore, be made in one piece and of a circular cross-section).

The rotating cylinder has the advantage of small friction and does not cause any tractive strain on the paper. On the other hand, the cylinder must have an exactly equal circumference at all points, and is, especially with the large diameters, expensive and difficult to manufacture.

The arrangement with stationary glass cover admits, on the contrary, the use of cheap glass that is not injured by slight unevenness and when normally annealed is not especially inclined to crack. With the application of three or four lamps in one machine with this arrangement the light is utilized better than with the first mentioned, as each of the mercury-vapor tubes does not absorb so much of the effective light of the others. Yet there is the disadvantage of the paper being pulled over the glass causing a greater friction and strain.

THE ELECTRICAL PART OF THE BLUE-PRINT MACHINES.

The lamps manufactured by the Cooper Hewitt Electric Company for blue-printing purposes are exclusively the stationary

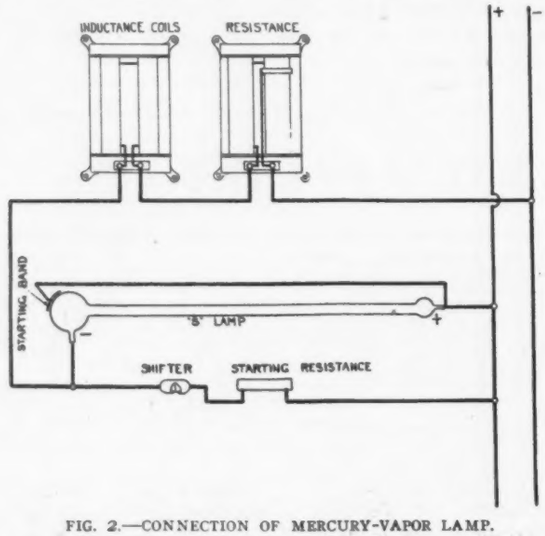


FIG. 2.—CONNECTION OF MERCURY-VAPOR LAMP.

horizontal-burning type for direct current. They may be connected on alternating-current lines by means of mercury-arc rectifiers.

The starting of the lamp is performed by means of a high-tension kick, created by quick interruption of the magnetizing current of an induction coil which is in series with the vacuum tube. The interrupter for this purpose, or so-called "shifter," consists of an evacuated glass vessel, as appears in Fig. 1, with two mercury electrodes, the contact of which is closed or opened by turning the shifter-holder by hand.

The electrical connections of the lamp are indicated in Fig. 2, which shows a single lamp on 110 volts. Inductance that serves for starting and steadying the mercury arc and a regulating resistance are in series with the lamp tube; in the shunt are the shifter and a shifter resistance that limits the magnetizing starting current to about 1 amp.

Machines for greater printing speeds are provided with two tubes that are connected in multiple on 110-volt or in series on 220-volt lines. In both of the latter arrangements use is made of a "starting inductance." This is a coil of great self-induction coefficient which in order to obtain an effective high-tension kick for starting, the lamp, is brought in series with the main inductance, and after the mercury arc is created is short-circuited.

THE MECHANICAL PARTS OF THE BLUE-PRINTING MACHINES.

(a.) The first and original continuous machine which has led to the development of all other similar types was the

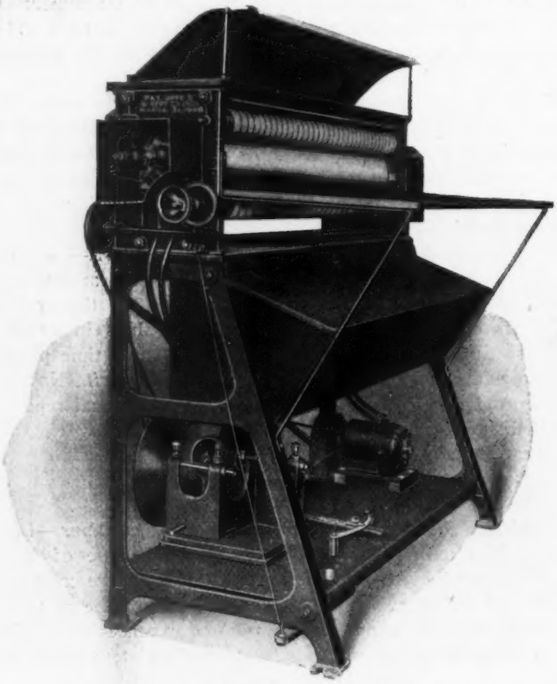


FIG. 3.—BLUE-PRINTING MACHINE.

Everett-McAdam machine, manufactured by the Revolute Machine Company, New York, N. Y. In this machine a horizontal glass cylinder containing generally two Cooper Hewitt tubes, as described above, lies in a series of 30 narrow belts which traverse three-fourths the circumference of the cylinder and return over wooden rollers. Paper and tracing are inserted between the belts and the glass cylinder, and rotate together with it. After a three-fourths revolution they are delivered into a receiving box. The last quarter of circumference that is not flanked by the paper is utilized by a reflector. Of the four rollers one is a drive roller, the other idlers. The first one is driven by a worm from a ⅛-hp electric motor by means of several pulleys and friction wheels.

The regulation of the paper velocity is accomplished at constant motor speed by a lever which moves a leather-shod wheel running between two friction disks. The rotation of the cylinder may be instantly stopped by pressing the handle down, thus lifting the worm off its gear, whereupon the glass cylinder can easily be turned in either direction by hand, if necessary to straighten the paper.

The traveling belts are of white-cotton webbing, and their tension can be changed by adjusting one roller with a screw.

The subdivision into many narrow belts is to secure a good contact of the paper and to allow the escape of air. The motor drives, in addition to the cylinder, a small fan for the ventilating of the lamps and glass cylinder. The machine is sometimes equipped with a feeding table, as in Fig. 3, and with a top

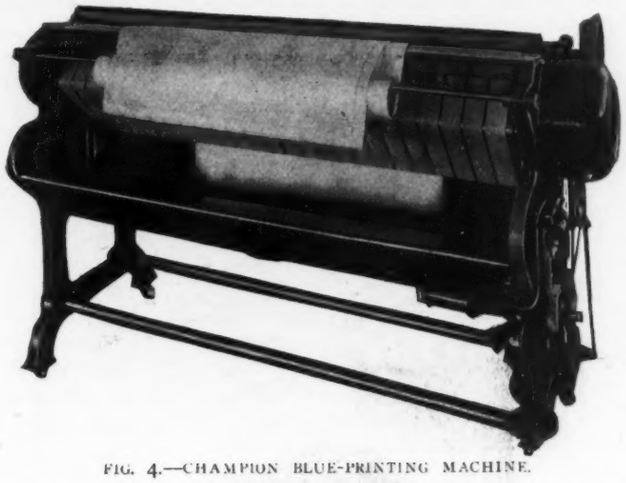


FIG. 4.—CHAMPION BLUE-PRINTING MACHINE.

casing, from which the sensitized paper is directly fed to the lamps.

The standard machine of this type has two lamp tubes, the light column of which is about 12 in. longer than the paper; a third lamp may be added when increased printing speed is wanted. The maximum paper width is 42 in. or 54 in., and the printing velocity from 3 ft. to 5 ft. per minute; the total power consumption is 1700 watts (including the motor).

(b) It is upon similar principles that the "Champion machine," made by the Keuffel & Esser Company, Hoboken, N. J., is based. The main difference between this and the above-described machine can at once be perceived by comparison of Figs. 3 and 4. In the Champion machine the space between feed-

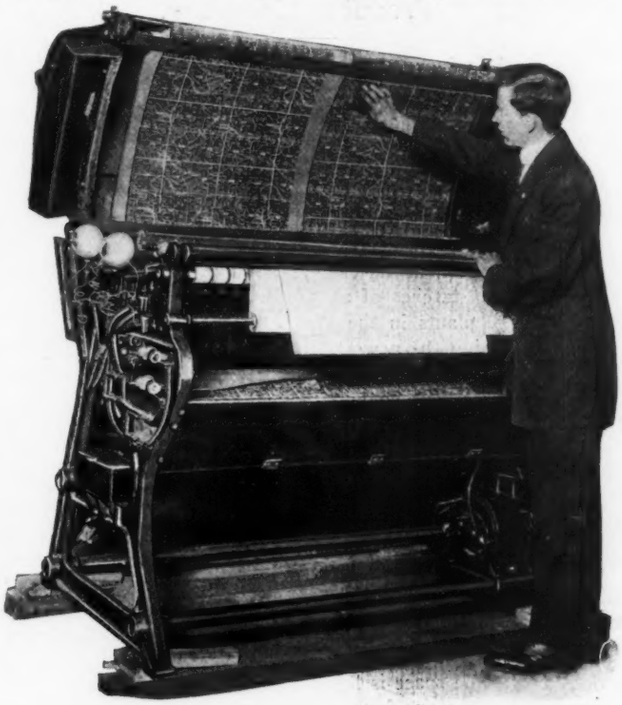


FIG. 5.—"DUPLEX" BLUE-PRINTING MACHINE.

ing-in and unrolling paper edges is reduced to a minimum by placing the upper rollers close together, thus saving the light lost in the reflector. The traveling belts of rubber are, as above, driven, by rollers by means of a worm gear and step pulleys from a small motor. One roller is adjustable by screws in order to give the belts the proper tension. The paper width is 54 in.; the copying speed and watt consumption are about the same as in the Everett-McAdam machine.

(c) To the second kind of construction mentioned in the introduction belongs to the "Tec Duplex" machine, made by the Technical Supply Company, New York. Two strong glass panes, Fig. 5, of an elliptic shape, the lower one being fixed in the machine frame, and the upper one movable, surround from two to four Cooper Hewitt tubes. Twenty-five narrow rubber belts for the upper glass cover and as many for the lower one, each moved by a drive and two guide rollers, seize the paper which is fed in at the front and pass it over the glass across the lamps. The belts are stretched by adjusting the bearings of the middle rollers. The upper machine frame, being equipped with a roll top, is suitable for storing prepared paper and is so arranged as to be turned on pivots, thus making both glass covers accessible for cleansing, even while the machine is in operation.

As is evident, it was the designer's object to make the two halves of the machine perfectly independent, and the same idea is followed out in the driving mechanism. A ⅛-hp motor operates the driving rollers through step pulleys, bevel gears and a double worm gear. By means of spur and chain gears

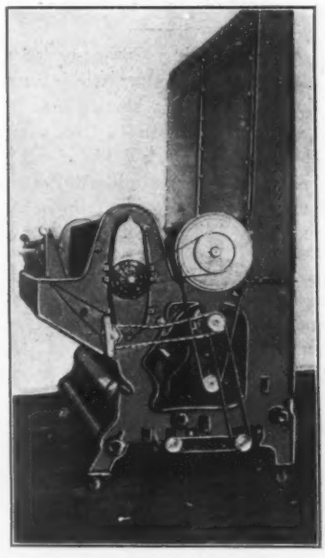


FIG. 6.—DE LUKACSEVICS BLUE-PRINTING MACHINE.

connected to clutches and operated by two levers, the two driving rollers may be coupled in the following ways:

1. In series; that is, both rollers having the same speed and feeding in the same direction, the paper thus performing a full revolution (with double velocity). 2. In multiple; that is, the rollers having the same speed, but feeding in a different direction; thus two tracings can be printed at the same time, each of them performing half a revolution (with single velocity). 3. Independently; the rollers feeding in different directions and with speed ratios of 1:4 or 1:8 for simultaneous printing of two papers with different sensitiveness—that is, blueprint and Vandyck.

The lamps are ventilated by a fan situated at the negative lamp end and enclosed in a hopper.

The glass panes measure 24 in. x 56 in., respectively, for a paper width of 54 in. The maximum obtainable paper velocity is about 3.5 ft. per minute for two tracings or 7 ft. per minute for one tracing.

Mr. Charles de Lukacsevics, to whom is due the design of the "Champion" and "Tec Duplex" machines, has recently developed an excellent type, made by the Acme Engineering & Machine Works, New York, as represented in Fig. 6.

The principle of the bipartite elliptic glass cover is retained also in this machine, but by reversing the axis of the ellipse a handy paper feeding and convenient arrangement of the driving mechanism is reached. The back part of the glass is again

fixed in the cast-iron frame of the machine, the front part being arranged for opening.

The Cooper Hewitt tubes are placed inside in well-insulated clamps, one above the other. Paper and tracing are inserted on the top, guided by 25 rubber belts which travel across the glass until after a full revolution they run off near the starting point. The belts are kept in tension by the adjustable roller bearings, and are driven by bevel and worm gears by means of a chain and two cone pulleys from the electric motor, the latter also driving a fan for the lamps. The paper velocity is controlled by adjusting the belt, coupling the two cone pulleys.

A principal part of the machine is the contrivance for sensitizing the paper. Plain paper runs from the storing roll over two preparing rollers, where it receives the sensitive coating from the bath. It is then led over a series of guide rollers and dried by electric heaters, finally feeding directly into the exposing contrivance. The heating is done partly by the current of the lamp resistances and partly by extra current. The preparing and exposing apparatus can be run together or independently, so that it is possible to make extra blue-print paper.

Electric Toaster.

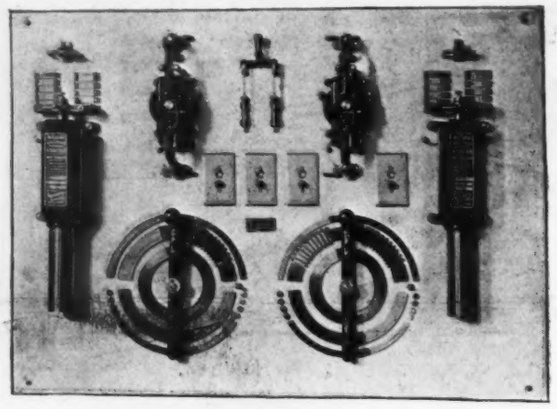
The Hoskins Manufacturing Company, of Detroit, has just placed on the market its first domestic, electrically heated appliance—the "Toastove." This device has a spirally coiled, exposed heating element, indented in the surface of the white composition heat-insulating block. The flexible twin-conductor cord with lamp plug, to fit any standard Edison socket, and the included pendant switch, that lays on the table beside it, combine to make the "Toastove" an attractive and useful addition to the dining table. The wire used for the heating element of the stove is that which has been used for years in the Hoskins electric furnaces. This first application of the electric furnace resistance element to comparatively low-temperature uses should prove an important step in the production of successful electrically heated appliances.

ELECTRIC TOASTER.

Controlling Panel in "New Theater," New York.

The controlling panel shown in the accompanying illustration is used in connection with the drape curtains in the New Theater, recently opened in New York City. This panel is on the stage director's board just back of the proscenium arch at the left. It comprises separate control for one 5-hp and one ½-hp motor, the former operating two pairs of front curtains which are pulled up diagonally, while the ½-hp motor operates a pair of curtains which are slid sideways from center to open. The timing of the movement of the back curtains is automatically accomplished by mechanism on the controlling apparatus, so that the third, or back curtain, begins to open a certain length of time after the front curtains have opened a certain distance.

On the panel are shown two "Clapper" switches with dynamic brake contacts, two "Acme" solenoid starters, two reversing speed-regulating hand controllers and four push buttons controlling the main magnet switches. The button in the center is a master button to control the buttons each side of it. The one at the extreme right is a button which permits the movement of the back curtain when the front curtains are closed. The direction and speed of the motor operating these curtains



CONTROLLING PANEL IN "NEW THEATER."

are set by the position of the hand-speed regulating arm. Limit switches are provided to slow down automatically the motors as the curtains approach their limit of movement, and other limit switches are provided to stop automatically the motors when the curtains reach their open or their closed positions. The use of such controlling panels is becoming general in modern theaters, and the extent to which such elaborate forms of control may be used is rapidly becoming more appreciated.

Power Plant at Argo Works of the Corn Products Company.

Among the private power plants in the Chicago area it would be difficult to find one more carefully designed to give the greatest economy in operation than that supplying steam and water, electrical energy and compressed air to the new works of the Corn Products Refining Company at Argo, Ill. Argo is a suburban settlement about two miles west of Chicago, and here the company has 124 acres of land in a strip nearly a mile long, extending from the Joliet highway to the Drainage Canal. With Indian corn as its raw material the company manufactures glucose, starches of all kinds, syrups and sugar. It has several large plants in the West, that at Argo, which is still unfinished, being the newest. It is said to be the intention of the company to make Argo the center of the glucose industry. There will be about 30 buildings in the establishment, all of steel and concrete, and such a liberal provision is made for daylight lighting that the walls have the appearance of being simply casings for windows, which form so great a proportion of the wall area that the visitor realizes he is in a region of glass houses. The lump-starch department is now running, and many of the other buildings are nearly completed.

The power house is placed at about the center of the property and, like the other buildings, is of steel and concrete construction and notable for the abundant provision of natural light. The engine room and boiler house are parallel to each other, and ample space is left for extension, the present engine plant being about one-fourth of the completed plant, while the equipment of boilers is about 30 per cent of the ultimate plant. The firing floor in the boiler room is placed about 12 ft. above the level of the engine-room floor. There are four round stacks built of radial brick. They extend 180 ft. above the grate bars of the furnaces and have an internal diameter of 7 ft. The stacks begin at the roof of the boiler house, 46 ft. above grade, and are supported on a massive steel structure.

The breeching from the boilers goes directly upward into the stack, with only one bend, making a very direct draft. One stack is provided for every two boilers, and every boiler in the whole station will have exactly the same draft as every other boiler. The placing of the stack on the roof saves floor space and makes the arrangement of the engine and boiler rooms more compact. There is simply a concrete wall between the two divisions of the power house.

Only about one-half of the steam generated in this station is used for power purposes. The remainder is supplied to various departments for cooking and evaporating purposes. The present power plant includes eight water-tube boilers, two large electric generators, an outfit of pumping machinery of impressive size, a cross-compound Corliss air compressor built by the Allis-Chalmers Company, having a capacity of 3000 cu. ft. of air a minute; a 20-ton overhead traveling crane, a large switchboard and the various exciters and boiler-room auxiliaries needed for the operation of a large plant. Ultimately the power house will contain 28 500-hp boilers and four 1500-kw generating units, while the other equipment will be correspondingly increased.

In the engine room a railroad switch track extends for one car length at the west end of the building and permits machinery to be unloaded easily. In the boiler room a railroad track extends the full length of the room. This is provided for emergency coal supply should anything happen to the coal-handling apparatus. It is interesting to note that the foundations for this track are entirely independent of those for the building and boilers, so that the running of loaded cars in the boiler room will not cause the setting of the boilers to crack from the vibration. There are separate toilet rooms with shower bath for the engine-room and boiler-room crews, and each division also has a separate toolroom. The floor of the engine-room is of compressed black and white cement tile, and the whole appearance of the plant is spacious and airy. Wherever the concrete foundations for machinery extend above the floor line they are enameled in black, so that they will have the appearance when finished of cast iron.

The coal and ash-handling apparatus is elaborately and carefully worked out. There is a gantry coal-handling equipment on the roof of the boiler-house, with two-ton grab buckets which hoist the coal from cars on a track outside the power-house and discharges it in 50-ton bunkers flush with the roof. There is one of these bunkers for each boiler. Below it is a 25-ton scale hopper for each boiler, so that the coal consumed can be individually weighed for each boiler unit. The coal is distributed to the chain grates of the boiler furnaces by fan-tail chutes attached to the bottom of the scale hoppers. The firing floor is 12 ft. above grade. The ash and fine-coal hoppers below the boilers are made of concrete. The empty coal cars are run underneath the boiler-room floor, and by a system of cast-iron valves the entire bottom of the ash hopper can be opened to dump the ashes into the cars. The fine coal sifted through the chain grate falls into the fine-coal hopper and is lifted up by grab buckets and returned to the coal-handling apparatus above.

At present there are eight 500-hp Babcock & Wilcox water-tube boilers provided with chain grates, as stated. All boilers are set singly, with a full set of clean-out doors on each side. On the steam line of each boiler is placed a Golden-Anderson cushioned, triple-acting, non-return valve, with pilot valve placed in a position to be readily accessible and convenient to the firemen. Each boiler is equipped with a recording flue-gas thermometer and a recording draft gage; also with recording CO_2 indicator. All of the indications from these instruments are shown in a case at the boiler front, and the arrangement is exceptionally accessible and convenient. All boiler-room auxiliaries, as feed pumps, feed-water heaters, oil filters and the like, are placed in a room with a 22-ft. ceiling under the boiler-room. The boiler-room is so high above the ground that the auxiliary room under it is amply lighted by windows at grade.

In the engine-room there is a 1500-kw, 600-volt, 25-cycle, three-phase alternator directly connected to a cross-compound engine turning at 107 r.p.m. Both engine and generator were built by the Allis-Chalmers Company. This is the principal generating unit of the present plant, and three others like it are to be added as the plant is extended. In addition, in the present plant, there is a 600-kw Allis-Chalmers alternator similar to the 1500-kw unit, only of smaller size. This is the auxiliary or reserve unit and it is operated when the large machine is shut down. The plant is run non-condensing. Both engine-driven and motor-driven exciters are provided, the latter having synchronous motors. There is also a direct-current generating set driven by a synchronous motor for supplying electricity to variable-speed motors in the toolroom. When the plant is finished there will be at least four of these sets, and the synchronous motors will improve the power factor.

The switchboard is of slate and is composed of 30 panels, blank panels being left for future generating units. A panel is provided for each of the 14 departments of the works, and there are individual recording and integrating wattmeters for each department, so that the consumption of electricity can be accurately determined. The motor and lighting circuits are wired directly from the switchboard, there being no other center of distribution about the premises.

Nearly 400 25-cycle General Electric motors will be installed in the various departments. These range in size from 110 down to 5 hp. Twenty-four of the motors are directly connected to pumps, five of these being vertical motors driving vertical pumps of the Byron-Jackson type operating in wells 1600 ft. deep. The remaining motors drive machinery for the various departments in the different mills, as starch-grinding mills, vertical stone mills, attrition mills, long line of shakers and conveyors, corn-cleaning machinery, elevator machinery, etc. The electric cables from the switchboard are laid underground, either in separate clay conduits or in fiber conduits, both embedded in concrete. Manholes leading to the electric cable conduits are provided for every building. The plans for lighting are not fully determined, but the yards and power-house will be illuminated by arc lamps, while incandescent lamps will be used in the other buildings. Two mercury vapor lamps are used in the lump-starch house.

The water supply in a manufacturing establishment of this character is of great importance, and very careful attention has been paid to this feature in designing the works. There are two sources of supply. One is the water from the Drainage Canal, which is used for boiler feed and also for condensing purposes. At the bank of the canal there have been installed three pairs of centrifugal pumps driven by electric motors. One pair of these pumps has a capacity for delivering 3,000,000 gal. of water a day; one pair is of 2,000,000 gal. capacity, and the third set is of 5,000,000 gal. capacity. The canal water is brought to a concrete tank 40 ft. x 20 ft. x 15 ft. located in the basement of the engine-room. From this tank Laidlaw-Dunn-Gordon Corliss cross-compound pumping engines of 5,000,000 gal. capacity force the water to the points where it is needed about the premises at a pressure of 50 lb.

The other source of water supply is from five deep wells 16 in. in diameter and 1600 ft. deep, driven by vertical electric motors, as previously mentioned. The well water is used in the manufacturing processes, as for steeping corn, etc. It is also used for fire protection, and a storage reservoir of 100,000 gal. capacity in an outdoor concrete tank, 60 ft. x 100 ft. by 15½ ft. deep, is provided for this purpose. A pumping engine similar to that used for the canal water, but having a capacity of 2,000,000 gal., forces the well water about the premises at a pressure of 75 lb. As an auxiliary to both of these pumps a Burnham twin-tandem compound pump of 5,000,000 gal. capacity can be used for pumping either canal or well water. It is arranged so that the entire pump or either side of it can be used for this purpose. Additional pumping equipment to be

added to the complete plant comprises a 5,000,000-gal. pump for well water and a 7,000,000-gal. pump for canal water.

A tunnel 12 ft. high and 16 ft. wide extends from the power-house in either direction, and through it all live-steam, water and exhaust-steam headers extend to all buildings. In this tunnel is also placed the compressed air piping and, in fact, piping of all descriptions necessary to connect the power-house center with the remainder of the works.

For fire protection a separate concrete building with roof flush with the ground has been erected just outside of the power-house and adjoining it. This contains three steam fire pumps, each having a capacity for supplying 1000 gal. a minute. Connected with this fire-pumping station is a complete system of hydrants and sprinklers located about the premises and in the various buildings. Great pains have been taken to comply with the requirements of the underwriters in every respect.

The whole engineering equipment is most complete, modern and carefully planned. It was designed and constructed under the direction of Mr. J. J. Merrill, chief engineer of the Corn Products Refining Company, of Chicago, who has charge of the electrical and mechanical engineering features of all of the company's plants.

A Large Self-Cooling Transformer.

The maximum size for which a transformer can be built self-cooling is limited by the amount of heat-radiating capacity for which the case can be designed. Standard cases with corrugated sides are regularly supplied with transformers up to about 600 or 750 kva, but beyond this size the weight and size

SELF-COOLING TRANSFORMER.

of the case became so great that some method, other than mere increase in size, must be resorted to in order to get the necessary radiating surface.

A type of case recently developed by the Westinghouse Electric & Manufacturing Company overcomes this difficulty and is capable of being designed for a greater radiating capacity than has ever been attempted for a self-cooled transformer. It consists simply of a plain boiler-iron case, to the outside of which are welded a number of radiating tubes. These tubes are in the vertical position and are given a 90-deg. bend at the top and bottom where they enter the case. The mechanical construction is very strong, so that there is practically no chance of the case leaking. Because of the ease with which the tubes can be widely separated from one another, the air circulates very freely among them, and the efficiency of the radiating surface is considerably higher than for the ordinary corrugated case.

There is a growing demand for large self-cooled transformers in substations and other places where water for cooling purposes is either not available or else very costly, or where weather conditions are so severe that water-cooled transformers may give trouble, or where it is desirable to have as little attendance as possible.

The Westinghouse Electric & Manufacturing Company has just built 12 1000-kw, 100,000-volt transformers of this type, shown in the illustration, for the Southern Power Company; three of these transformers are for outdoor service and nine for indoor.

Exhibits at the Boston Electric Show.

In addition to the central exhibit of the Edison Electric Illuminating Company of Boston, described elsewhere, which is in charge of Mr. Herbert W. Moses, many of the prominent electrical manufacturing companies have noteworthy exhibits at the Boston Electrical Show.

The General Electric Company's booth is located in the central part of the hall to the right of the middle aisle. A large variety of lamps, motors and heating equipments is shown, including motor-driven tools, heating equipment for domestic and industrial service, flaming, intensified and multiple-arc lamps, sewing-machine motors, tungsten lamps of all sizes and for various voltages, automobile lamps, switchboard instruments and mechanisms, motor-starting compensator panel for remote control, Christmas-tree lighting outfits and street series tungsten-lamp bracket, miniature and sign lamps. Among the newer features is a 2-hp, 220-volt repulsion-induction motor with a commutator for starting and taps for alternating-current operation alone at full speed. A full line of small induction motors, from 1/30 hp up, is shown, with a display of large and small electric fans in operation. Ceiling fans and blowers are shown, with a variety of starting boxes and rheostats. The electric heating exhibit comprises a full line of cooking utensils, including a new chafing dish with extra cooking pan, an attached switch preventing the necessity of withdrawing the plug when cutting it out of service; a new 700-watt sealing-wax heater with three-heat switch attached, and a percolator with single drip. Toast is made electrically for visitors. The heating division is in charge of Mrs. Howard Collins, of the Boston office, assisted by Miss Schobecker, of Schenectady. Other representatives present are: Messrs. F. H. Gale, manager advertising department, Schenectady, in general charge; C. B. Davis, manager Boston office; J. P. Felton, manager supply department, Boston; Messrs. Brown, D. G. Brokaw, R. B. Hampson, George Hunter, S. W. McCollum, Jr., O. F. Brastow, Boston; F. W. Willcox, Harrison, N. J., and C. W. Bettcher, Harrison, N. J. The exhibit was installed by Mr. L. W. Shugg, Schenectady.

The Westinghouse Electric & Manufacturing Company is occupying a large booth on the left side of the center aisle, and is making a specialty of household devices, including electrically heated and motor-driven utensils and equipment for a wide variety of domestic service. Industrial applications are also shown throughout an extensive range. The company has four demonstrators. One operates the Westinghouse toaster stove, which is used for corn popping for the first time in public, and the second the electric flatirons displayed. The third operates a motor-driven sewing machine, and the garments made are ironed electrically and then donated to charity. The fourth demonstrator operates a "Free" sewing machine in connection with the making of fancy patterns. The electric motor display includes a variety of machines for direct connection power service. Among these are the Pittsburgh rotary air pump, Royal meat choppers and coffee grinders, Burroughs electric adding machines, Sirocco fans and blowers for portable and stationary services, erasing outfit for draughting-rooms, American forge blower, and Miller-Tyson ice-cream freezer. The

company is represented by Messrs. G. M. Bates, manager of the Boston office; R. Barnes, Jr., of Pittsburgh, and Messrs. C. P. Wahn, I. P. Sprague, M. B. Chase, S. S. Bell, George Gibbs, George C. Ewing and S. S. J. Morgan, of the Boston office.

The Electrical Testing Laboratories, New York, exhibited a large cabinet showing the effects of different illuminants on the colors of the spectrum. A new device shown by this organization consists of a portable testing box containing a millivoltmeter, battery of three cells, resistance shunt, 75-ft. tape and small tool compartment, the outfit being only 7¼ in. square by 11 in. high. All the resistance is in when the cover is closed to protect the photometer lamps. The laboratory is also showing a standard Sharp-Miller portable photometer.

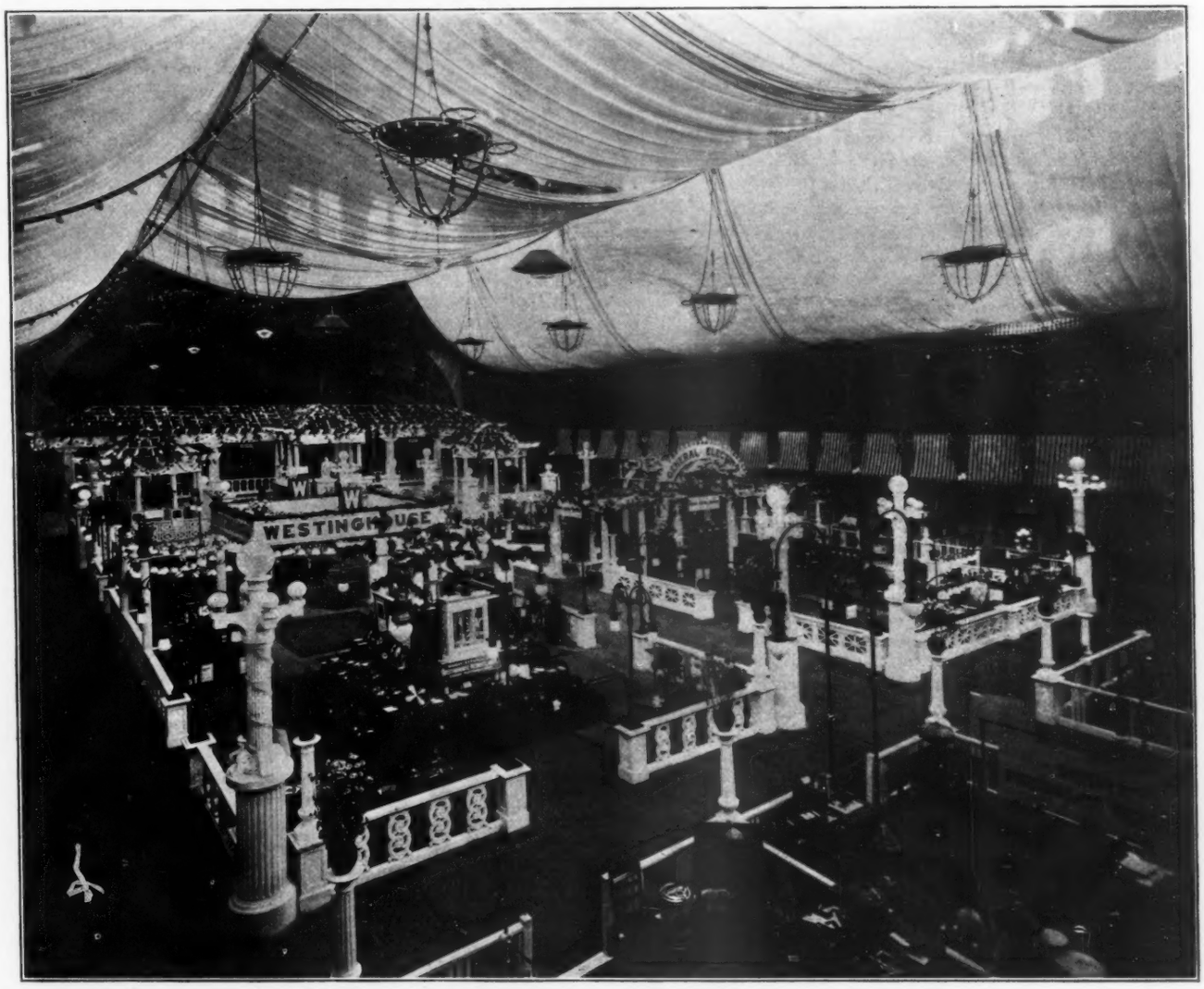
The Engineering Department of the National Electric Lamp Association is showing a full line of tungsten, tantalum and Gem lamps. A new feature of the exhibit is a cabinet showing the different stages in the manufacture of a carbon incandescent lamp, from the cotton to the completed bulb and filament. A similar cabinet shows 13 different steps in the preparation of a tungsten filament, from wolframite to the final treated wire. The organization is represented by Messrs. P. F. Bauder, A. C. Andrews and C. O. Brandell, all of Cleveland.

The Westchester Appliance Company, Boston, features a line of its No. 6 square and round dry batteries. A seven-tube vacuum lighting outfit is installed and operated by a small motor. The current for the tubes is supplied through an induction coil connected with the company's batteries.

The Boston Elevated Railway Company has taken a large exhibit space and is showing a complete automatic working model of the company's elevated track and third-rail construction, equipped with an electric locomotive and full-sized block signals. A full-sized working electro-pneumatic interlocking track switch of manganese steel is also shown, with a display of all the kinds of wire and cable used by the company. The exhibit was prepared in a week by the inspector of signals, Mr. W. C. Smith, and the roadmaster, Mr. H. M. Steward, assisted by a force of 50 men. The signals are of the Union Switch & Signal Company's make. The exhibit is in charge of Mr. George Sabin Brush.

Elaborately decorated floats are operated on the lines of the Boston Elevated Railway Company each night to advertise the show. These are equipped with electric signs, ornamental lamps, tastefully draped curtains and artificial sprays of leaves.

The Invincible Electrical Renovators Sales Company, Boston,



GENERAL VIEW OF BOSTON ELECTRICAL SHOW.

is exhibiting domestic and junior machines for vacuum cleaning. These machines are of the two-stage turbine type with a single moving element, aluminum casings and pipes. The company is represented by Messrs. A. W. Patterson, Jr., manager, and C. F. Patterson.

The Albert & J. M. Anderson Manufacturing Company, of Boston, displays a full line of electric time switches, knife switches for single and multiple-blade service, switchboard and copper fittings, trolley insulating material and cell switches, and a 400-amp remote-control switch and circuit-breakers. Representatives in attendance are Messrs. Andrew Anderson, George Crane and Alf. Anderson.

The Allis-Chalmers Company, Milwaukee, is exhibiting a line of power equipment, including direct-current and alternating-

current motors, transformers of various sizes, air compressors and a motor-driven installation of line shafting, coupling and clutch equipment. Mr. Frank Bolles is in charge of the exhibit.

The Duntley Manufacturing Company, of Chicago, is exhibiting five sizes of its electrically driven pneumatic cleaner outfits, including a cleaner installation for domestic service and a carriage plant for industrial operation, hotels and large mercantile establishments. It is represented by the Edison Electric Illuminating Company, of Boston, agents for the Duntley company in the territory served by its lines.

The Stuart-Howland Company, of Boston, is showing a full line of Paiste wiring material, Excello arc lamps for alternating-current and direct-current service, "Daylight" arc lamps, heater, motor and lamp supplies at its booth on the center aisle of the show. Among the specialties exhibited are flatirons, the "El Tosto" toaster and miscellaneous small domestic heating appliances made by the Pacific Electric Heating Company, of Ontario, Cal.; Allen-Bradbury controllers for heavy motor starting on the carbon-disk principle, Fabious-Henrion carbons, Hartford time switches, Krantz switchboard material, Chase-Shawmut fuses, Crous-Hinds condulets, Carey inner globes and enameled-steel reflectors, the Ilg Electric Ventilating Company's (of Chicago) motor-driven fans and blowers, the Gray telautograph, American arc rectifier for storage-battery charging, Holbrook excess-current register and Sterling line of lamps and ornamental shades. The company is represented by Messrs. G. M. Stuart, A. H. Howland, A. E. Payne, C. R. Fish, G. H. Wahn, J. T. Hessel, F. Mullock, S. P. Thierman, H. McKay and J. B. Bailey.

The Boston Electrical Contractors' Association is occupying an illuminated arbor near the entrance of the hall, the exhibit covering wooden-molding, iron-conduit cleat and metal-molding wiring systems, enclosed fuses, sign flashers, fan motors, cabinets and cut-out boxes, ornamental hanging lamps, Christmas-tree electric lighting, electric fountain and a Standard Electric Time Company's clock. Mr. T. W. Norris is in charge.

Mr. Leon W. Bishop, of the Tri-Mount Wireless Supply Company, of Boston, is showing in operation at the exhibition the Bishop wireless telephone. Mr. Bishop is also giving lectures at the hall in connection with his exhibit on the subject of wireless telephony and telegraphy. In attendance are Messrs. L. W. Bishop and Robert A. Chandler.

The Edison Manufacturing Company, Orange, N. J., is showing a line of moving-picture machines and giving six exhibitions of dramatic subjects in the lower hall each day. The Edison Business Phonograph Company, of Orange, through its New England representative, the Eastern Talking Machine Company, of Boston, is exhibiting motor-driven phonographs for mercantile use, the motor being of the universal type and capable of operating on a direct-current or any alternating-current commercial lighting circuit without regard to voltage and frequency. The two companies are represented by Mr. M. J. Reid, of Boston.

The National-Acme Manufacturing Company, of Cleveland, is showing a motor-driven screw-making machine. The company is represented by Messrs. Henn, Judd and Brunner.

The Stackpole Battery Company, of St. Marys, Pa., is featuring its arc-lamp carbons, dynamo brushes and carbon brushes for moving-picture machine motors. The company is represented by Messrs. H. E. Stover and O. L. Turgeon.

The Bay State Electric Company, of Boston, is displaying ornamental lamps for banquet table use. The company is represented by Mr. C. A. Rounds, manager.

The J. H. Day Company, Cincinnati, is exhibiting a full line of motor-driven bakery machinery, including dough mixers as used on the battleships of the United States Navy; icing machines, kneaders, pulverizers, churns, driers and also paint and ink-making machinery. In attendance are Messrs. G. H. Petri and E. A. Johnson.

The W. S. Quinby Company, Boston, is showing motor-driven coffee roasters. It is represented by Mr. Elmer French.

The Electric Boat Company is exhibiting a model electric submarine torpedo boat by its representative, the Electric Storage Battery Company, of Philadelphia.

The Electric Cleaner Company, of Chicago, exhibits a line of portable cabinet cleaners of the motor-driven, closed type, with parts of the apparatus thrown open for inspection. The company is represented by Mr. A. B. Cousin, of New York.

The Shelton Electric Company, Boston, is displaying vibrators, hair driers; and Knight & Lowenburg, Boston, are exhibiting x-ray cabinets, fluoroscopes and a static machine using mica plates instead of glass. The company is represented by Mr. A. S. Moffat.

Mr. Earle L. Ovington, New York, is giving several daily lectures at the show on high-frequency phenomena. Mr. L. D. Gibbs, assistant advertising manager of the Boston Edison Company, is giving lantern-slide lectures on the "Home Electrical" and kindred topics.

The Condit Electrical Manufacturing Company, of Boston, is showing a full line of Chase-Shawmut wiring material, Boston cable clips, rail bonds of the Shawmut type, Condit oil circuit-breakers, carbon brake-breakers, the new Burnham regulator, a new Condit electrically operated remote-control oil switch. In attendance are Messrs. S. B. Condit, Jr., Badeau, Burnham, Green and Masterson.

S. B. Condit, Jr., & Company, Boston, are showing Alphaduct, Sterling flexible steel conduit, conduit fittings, and Orangeburg fiber conduit. The company is represented by Messrs. Condit and Dow.

The Clapp-Easthan Company, Boston, is showing a complete line of wireless telegraph apparatus. The company is also showing in operation Prof. Elihu Thomson's induction motor. In attendance are Messrs. M. Eastham and R. B. Hoit.

The Simplex Electrical Company, Boston, is displaying a wide range of special cables for high-tension and low-tension service including three-phase and single-phase lead-covered, armored and paper-insulated cable, telephone pairs, and rubber-covered wire. Messrs. Stone, Ingalls and Emerson are in attendance.

The Simplex Electric Heating Company, of Cambridge, Mass., is showing practically every standard device which it produces for domestic and commercial service. There are also shown a full line of flatirons, kettles, chafing dishes, percolaters, heaters for industrial service and domestic appliances of great variety.

The Hurley Machine Company, Chicago, is exhibiting two sizes of electric washing machines and the Thor-Electric clothes wringer. The company is represented by N. H. Haberle.

The Dow Surgical Battery Company, Boston, exhibits the Arnold massage vibrator, Arnold electric cleaner, and batteries. The company is represented by Messrs. Williams and Harrington.

The Holtzer-Cabot Electric Company, of Brookline, Mass., is showing a large assortment of telephone, signaling and power equipment of both standard and special design. The company is represented by Messrs. C. W. Holtzer, T. W. Ness, Archie Ness, M. J. McElroy, A. P. Waterman and Balcomb.

G. M. Gest, conduit engineer and contractor, New York, is showing a full-sized partially completed brick and concrete manhole, equipped with Gest adjustable cable racks. Mr. Gest is represented at the show by Mr. H. H. Stannard.

The Diehl Manufacturing Company, of Elizabethport, N. J., is showing a full line of motors for sewing machine and fan service, with alternating-current and direct-current motors for miscellaneous small machine tool operation. A special exhibit is the company's "Universal" type of fan motor of the oscillatory design. The company was represented by Mr. W. P. Miner. In the same booth the Singer Sewing Machine Company, New York, displayed its motor-driven products for domestic and industrial service. Mr. T. H. Madigan was in attendance.

The International Correspondence Schools, of Scranton, Pa., are displaying books, instruments for drawing service, instruction course matter and pictorial outlines of its work. Mr. R. Burnham is in charge of the exhibit.

The Blake Signal & Manufacturing Company, Boston, is showing insulated staples, tube flux (Blake type), compressed wood cleats, and snap extension curtain rods and holders. Mr. Frank Macomber is in charge.

The H. B. Camp Company, Boston, is exhibiting a full-sized brick manhole equipped with Camp duct, single and multiple stacks of duct, cables and concrete. The company is represented by Mr. Kirlsey.

The Franklin A. Snow Company, Boston, contractors for underground construction, is showing a full-sized Edison manhole cover as used in Boston, and is represented by Mr. F. A. Snow.

The Electric Storage Battery Company, of Philadelphia, shows a cell of type H-77 Exide battery. The company was represented by Mr. Frank J. Stone, New England manager, and Messrs. Luther, Bedford and Kerrick, of the Boston office.

The Burlingame Telegraphing Typewriter Company, Boston, exhibits two machines in operation, and distributed folders describing this invention. The company was represented by Mr. J. H. Bowling.

Fred T. Ley & Company, Springfield, Mass., was represented by Messrs. M. W. Denman and A. E. Rock.

The Campbell Electric Company, Lynn, Mass., show an eight-day time switch, portable X-ray outfits by which the physician can apply radiographic treatment to the patient at the latter's residence, medical glass-ware, a bell-ringing transformer cutting the voltage from 110 to 21.14, or 7 volts, and a low-voltage transformer or economy coil for use in low-potential tungsten lighting. The company was represented by Mr. L. E. Gott.

The Radio Reflector Company, New York, is showing its reflectors on both carbon and tungsten lamps. A cabinet has been erected in the company's booth which shows 27 16-cp carbon lamps with the reflector attachment and 27 lamps bare, flashing alternately. Mr. S. S. Adams is in charge of the exhibit.

The American Flaming Arc Company, Boston, is showing 5½-amp to 10-amp, 80-volt, multiple, direct-current arc lamps of the flaming type, and also 9-amp to 10-amp, alternating-current, multiple arc lamps, operating on 72 volts at the arc. The arc in these lamps is controlled magnetically, and the arc striking and extinguishing mechanism are mutually independent. The arc is spread out by a pair of series magnets located near the horizontal plane of the electrode ends. The arc runs with maximum steadiness as a result of this magnetic control. Inner globes are eliminated. The company is represented by Messrs. C. D. Lanning, J. D. Robinson and W. H. Baker.

Durent & Kendall, of Boston, are showing the "Santos" vacuum cleaner, the apparatus having glass windows so that full detailed operation may be observed. The portable outfit weighs only 50 lb. Messrs. Durent, Kendall and Mr. and Mrs. R. M. Kitson are showing the apparatus to visitors at the booth.

The "1900" Washer Company, of Binghamton, N. Y., is displaying a line of motor and water-driven washers, with a hand machine in addition. A power wringer, electrically driven, is also shown. In attendance are Messrs. Terry and Bedore.

The Baker electric vehicles are exhibited by Mr. A. F. Neale, of Boston. The display includes a 1910 model victoria and a 1910 model extension front coupé, interior driven.

The Dodge Motor Vehicle Company, Boston, is showing a line of "Waverly" electrics. The company is represented by Messrs. H. W. Lincoln and R. L. Pope.

S. S. Bailey & Company, Amesbury, Mass., are showing a car that ran 175 miles on a single charge, with Edison battery equipment. Forty cells are installed. In attendance are Col. E. W. M. Bailey and Mr. P. E. Whiting.

The Dearborn Drug & Chemical Works, of Chicago, exhibits its products and is represented by Mr. P. H. Hogan, of Boston.

The Anderson Carriage Company, of Detroit, Mich., is exhibiting the well-known "Detroit" electrics. The company is represented by Mr. J. A. Binney.

The Studebaker Brothers Company, New York, are displaying a 1500-lb. delivery wagon of the electric type, and a landaulet, with spring-supported battery and swinging adjustable top. The company is represented by Messrs. H. L. Converse and S. G. Thompson.

The Rae Electric Vehicle Company, Boston, is showing a victoria which has run 16,621 miles, and which made 150 miles on a single charge. In attendance is Mr. H. C. Welch.

P. R. Ziegler & Company, of Boston, show four cows in "Snow" sanitary stalls. These cows are kept close by a model dairy and are electrically milked daily. The dairy is operated by D. Whiting & Sons, of Boston, a well-known milk house.

The Edison Electric Illuminating Company, of Boston, has fitted up a complete five-room electric house in the basement of the hall, the rooms being equipped with innumerable electrical conveniences.

The Ever-Ready Flash Light Company, Boston, shows its specialities for hand and pocket service. It is represented by Mr. S. S. Shepard.

C. S. Knowles, Boston, occupies a large space in the basement, and is showing a full line of Klaxon automobile horns, railway fittings, line material, high-tension insulators, conduit, and "Excel" electric heating devices. The new Klaxon automobile tail lights are shown, with a railway semaphore lens and downward reflector. A spring is provided to prevent the jarring loose of the lamp and consequent loss of the light. The house is represented by Messrs. Sabin, Kennedy and Ober.

W. J. Murdock & Company, Chelsea, Mass., show a line of wireless telegraph apparatus in operation and on display. Mr. J. A. McCarron is in attendance.

The Rudolph Wurlitzer Company, New York, shows a line of electric self-playing instruments, including a player piano, piano orchestra, and violin piano. In attendance is Mr. L. S. Lockwood.

The Poole Printing Company, Boston, shows a complete job printing establishment. The motors in the exhibit are mainly of the C & C type, supplied by the Garwood Electric Company, of New York.

The Electro-Radiant Sign Company, of Boston, is showing a motor-driven sign for barber-shop service.

The Invincible Electric Renovator Sales Company, Boston, is showing a portable vacuum cleaner outfit in large and small sizes. Mr. A. W. Patterson, Jr., of Boston, is in attendance.

The Massachusetts Fan Company, Watertown, Mass., is showing motor-driven Davidson ventilating fans for industrial service.

The Boston Lightning Rod Company is exhibiting copper and galvanized iron lightning rods, Mr. H. L. Willard being on hand to greet visitors.

The Perfection Manufacturing Company, of Portland, Me., is showing a motor-driven dish washer of large capacity. Mr. G. M. Cram is present in the interest of the company.

The Cyphers Incubator Company, Boston, showed an electric incubator hatching 155 chicks per day. The incubator was fitted with glass so that all the operations incidental to hatching could be seen readily.

The Positive Electric Vacuum Cleaner, built by the Electric Cleaner Company, of Chicago, was shown by Mr. A. B. Cousin, New York. A special feature is the cabinet construction of the device.

Fox Brothers & Company, New York, displayed the new German "Polar" flaming arc, which is stated to burn 20 hours per trim, and to have a low-maintenance cost. Sunray electric lamps were also shown in this booth. The booth is in charge of Mr. Eugene Godfrey.

The Alternating Target Company, Boston, showed an electric baseball alley, Mr. W. H. Bryant being in attendance.

The Baker Vacuum Cleaning Machine Company, Boston, was represented by Mr. Benjamin Sargent.

The *Electrical World* was represented by Messrs. Elliott and Knowlton.

Service and Meter Box.

The service and meter box shown has been designed by the Detroit Fuse & Manufacturing Company to meet a demand for a box that will alone serve as a main switch and cut-out, prevent theft of current and provide proper terminals for meter

FIG. 1.—SERVICE AND METER BOX.

testing. The box is compact and substantial, yet allows plenty of room for wiring and testing, and complies with all requirements as to spacing.

The main switch and cut-out embodies the knife-switch mechanism of the "Detroit" ironclad fused switch, which is absolutely positive in its action, which mechanism is controlled by a plunger from the outside of the box. It is claimed that

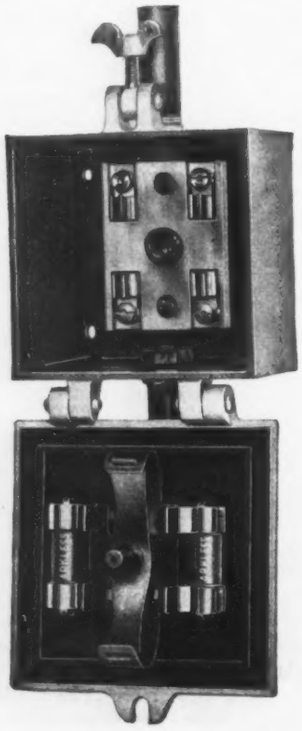


FIG. 2.—SERVICE AND METER BOX OPEN.

this is the only switch that can be sealed against tampering and yet is instantly accessible to the consumer. The switch, moreover, gives complete protection from moisture, dirt, fire and fumes, and all live terminals being completely enclosed, there is no possibility of accidental contact in operating the switch. The fuses are mounted on the inside of the cover, swinging away from all live terminals when the cover is opened, and eliminating all danger when replacing blown fuses.

The inspection or meter chamber at the bottom of the switch is provided with a separate seal and allows of testing the meter without interfering with the service to the consumer and at quite a saving in time over old methods. This feature is of special value, as most lighting companies realize that the frequent testing of meters is decidedly advantageous, and the saving in time from using this device, it is stated, will soon pay for its cost.

Fig. 1 shows the switch as designed for entrance in conduit and open-work after leaving the meter box. It will be noted that conduit is also run from the meter box to the meter, thus preventing theft of current or tampering. The meter box is drilled on both sides, one side being plugged, making it possible to install the meter in any location.

Fig. 2 shows the mechanism of the "Detroit" ironclad fused switch; it will be noted that the fuses are mounted on the switch blades, making this portion of the service box very compact. The mechanism is simple in construction, and the spring is of sufficient strength to control the switch independent of outside pressure.

Automanual Telephone Equipments.

The relative simplicity of the so-called "automanual" telephone installation in comparison with a manual equipment will be appreciated when one considers the appearance of a manual operator's switchboard while examining the key bench of the

FIG. 1.—KEY BENCHES FOR TWO OPERATORS.

automanual system illustrated in Fig. 1. The bench contains only three simple sets of keys and three sets of lamps.

The system can best be explained by outlining the operator's duties. An entering call causes the lamp of one set to be lighted; the operator presses her listening key, thereby connecting her head set to the calling line and, having ascertained the number of the subscriber desired, she presses keys corresponding to this number and touches a starting key which releases the relay brought into service by the listening key and starts the calling connection through automatic switches, where it is completed. All conversations between subscribers are absolutely private, it being impossible for two sets of subscribers to be joined to the same circuit, and even the operator cannot overhear the conversation.

The subscriber's equipment consists of telephone apparatus identical with that used with the ordinary common-battery system. His metallic circuits enter the exchange building and pass through the usual main frame terminals and protectors to be ended upon the usual line relays and cut-off relays; the local trunks or link circuits between the primary selector and first selector switches are provided with condensers, and sleeve and tip relays bridged on the main battery, so that the circuit conditions are identical with those in standard common-battery manual boards. All of the switches and relays are mounted in the usual manner upon iron racks apart from the operating-room.

The details of the automanual equipment will be understood from a description of the various operations performed thereby. When a subscriber calls by taking down his receiver, his line relay causes a primary selector switch to connect his line with an idle local trunk or link circuit, and at the same time starts

a secondary selector switch which immediately connects the primary trunk and the calling line to an operator's idle-key set. The key-set lamp then lights, thereby indicating a call, the operator presses her listening key as usual, ascertains the number desired, and depresses the corresponding buttons, thereby determining the number of impulses to be sent to the selector

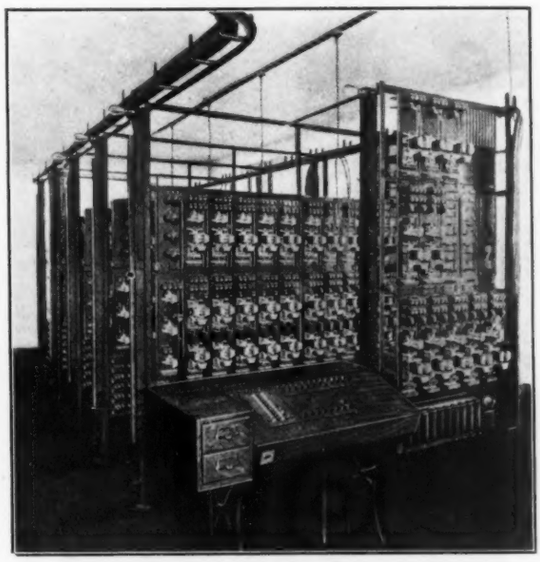


FIG. 2.—WIRE CHIEF'S DESK AND AUTOMANUAL SWITCHING EQUIPMENT.

and connector switches to make the desired connection. The sending machine transmits the predetermined impulses to the switches, which then select, test and signal the wanted line automatically. As soon as this line is selected, however, the secondary selector or operator's switch is automatically released and restored to normal position, ready for another call.

The subscribers have entire control of their own connection, being in this respect situated precisely as in a full automatic ex-

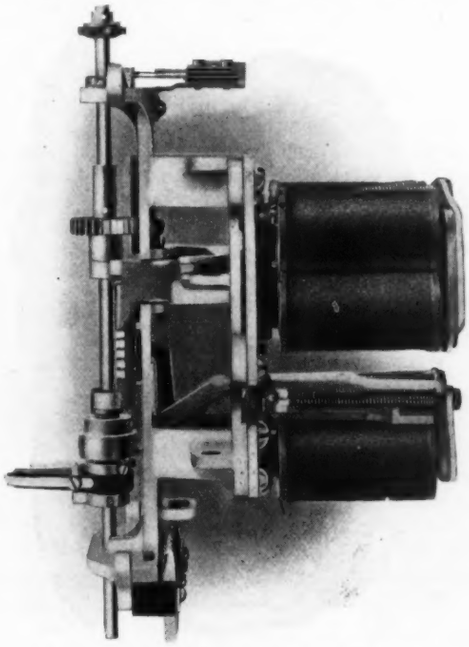


FIG. 3.—TWO-MOTION, 100-POINT SWITCH.

change, and from the explanation given it will be observed that they are secure from interruption. To clear-out or make a recall the subscribers simply hang up their receivers and the switches are automatically restored.

Aside from standard equipment incident to all common-battery installations, such as power plant, protecting and ringing devices, there are only five different pieces of apparatus required to complete an automanual installation, namely: the impulse or sending machine; the operator's keys; the automanual relay; the 100-point two-motion switch, and the 20-point one-motion switch. The sending machine consists of a drum upon

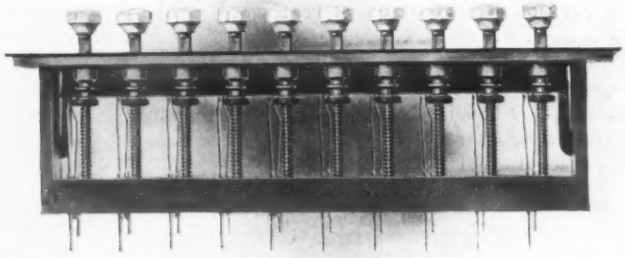


FIG. 4.—STRIP OF OPERATOR'S KEYS.

which are placed cams arranged to furnish impulses from 1 to 10 in accordance with the keys depressed by the operator. It is driven by a small motor receiving energy directly from the storage batteries. This sending machine is common to the entire system and performs for the system the same functions that in a full automatic installation are performed by the dial or sending device, located at each subscriber's telephone, and herein lies one of the distinctive features of the automanual

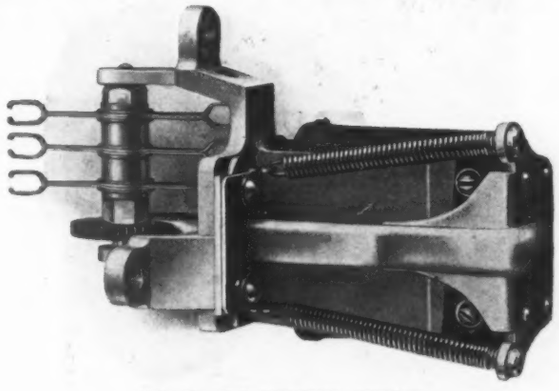


FIG. 5.—DISTRIBUTING SWITCH.

as a system, namely, the elimination of the dial. Sending machines are required at only the point where operators are located, none being used at branch exchanges.

The relay consists of a core upon which the wire is wound, a frame, an armature and a spring block which serves the double purpose of carrying the contact springs and retaining the armature in place, at the same time allowing freedom of movement.

The 100-point switch provides three switch-movements:

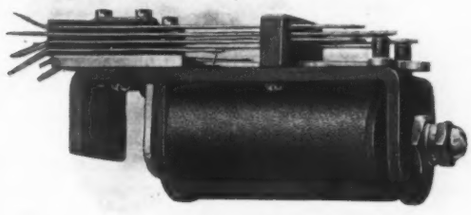


FIG. 6.—AUTOMANUAL RELAY.

rotary, vertical and release, the arrangement being as indicated in Fig. 3. The 20-point, one-motion switch is similar in construction to the 100-point switch. All of these devices are characterized by extreme simplicity.

The first automanual telephone equipment to be placed in

commercial service was that at Ashtabula, Ohio, a city having a population of about 20,000 people, of whom 5000 reside at Harbor, about four miles from the main town. The older manual telephone system required seven operators at Harbor and 30 at the main city exchange. The North Electric Company, Cleveland, Ohio, contracted to re-equip both the main city and the Harbor exchanges, with the idea of starting first at the Harbor with local operators, and after that was successfully working, equipping the main exchange so as to centralize all the operators therein, leaving the Harbor exchange practically an automatic branch. By following this plan, additional economies will be effected in that the day load at the Harbor will require only one additional operator at the main exchange, and the night load will be handled by a single operator at the city exchange. At Ashtabula Harbor there are installed five 100-line units adapted for either single-line or party-line service.

Printing-Press Controllers.

The General Electric Company has developed a complete line of controllers designed to meet the requirements and severe service of small direct-current, electrically operated printing presses. In their design special attention has been given to such necessary features as no-voltage protection, overload protection, push-button stop and jog, ruggedness of construction and accessibility.

FIG. 1.—PRINTING-PRESS CONTROLLER.

All controllers have no-voltage protection, consisting of a contactor mounted in the lower left-hand corner of the slate front. One type is so designed that upon failure of voltage the starting arm returns automatically to the off position. In addition, the controller arm is provided with a movable armature which may be adjusted so that the motor can be run only at a certain predetermined speed. All the other controllers of this line have been so designed that the contactor opens when the voltage fails and the contactor cannot be closed until the controller handle has been returned to the off position.

Since the armature circuit is made and broken by the contactor and not on the switch contacts, there is no arcing on the contacts. This eliminates the burning of the contacts, which would necessarily result in roughening the surface, causing imperfect contact and the rapid destruction of the contact segments. The contactor is provided with a strong magnetic blowout which extinguishes any arc that may result when the armature circuit is opened. When the overload release is supplied in addition to the no-voltage release, it is so connected that when it operates it will de-energize the contactor coil, opening the contactor and thus breaking the armature circuit.

In many installations it is desirable to have push buttons located at various points around the press for stopping the motor or for "inching" the press when necessary. Some of the

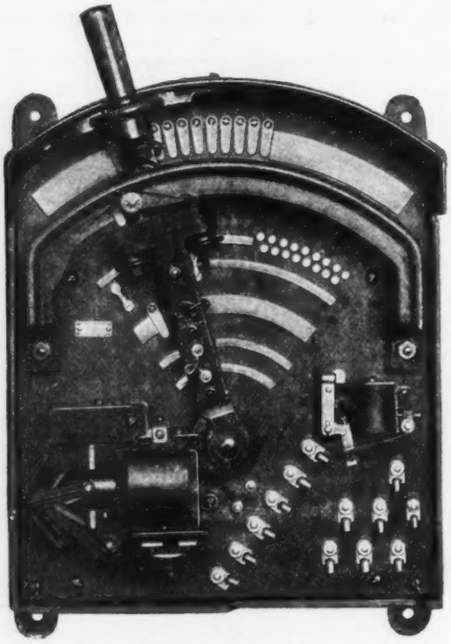


FIG. 2.—CONTROLLER WITH COVER REMOVED.

controllers have therefore been designed to have both push-button stop and go, while others have the stop feature only.

If the push button is closed while the motor is not in operation the contactor will close, providing the switch is in the starting position, completing the armature circuit through the regulating resistance. This will start the motor, which will run very slowly as long as the push button is held closed. If the push button is closed while the motor is running, the contactor coil will be de-energized, thereby opening the motor circuit and stopping the motor. The same push button can, therefore, be used for jogging or stopping the motor. Each controller which has the stop-and-jog feature is furnished with two buttons, but any number of buttons may be installed.

Standard resistance units are used throughout. In the controllers having a field regulating resistance, the units are assembled upon the back of the slate front, while the armature resistance, whether for starting or regulating duty, is assembled in a separate box. When a dynamic brake is supplied, the resistance is in most cases external, but in some controllers it is self-contained.

The controllers are provided with renewable segments for

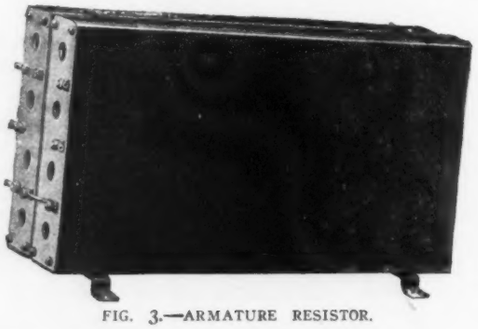


FIG. 3.—ARMATURE RESISTOR.

armature control, while button contacts are used for field control. The starting resistance is designed for starting duty only while the armature regulating resistance is designed for continuous operation, as various speed changes are obtained by varying the amount of resistance in the armature circuit.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The colder weather throughout the country during the past week has acted as a stimulant to retail trade. While there has been fair trading in this branch of business all during the fall, heavy clothing and underwear were showing a disposition to lag. Not only in these lines, but in shoes and in the coal trade a special improvement is to be noted. Wholesalers and jobbers are receiving much better orders and already holiday orders are received in encouraging numbers. Some reorders are beginning to come in. The change to more seasonable weather has also brought a distinct improvement to the crop situation in the West, checking the too rapid growth of winter wheat and breaking a drought in the Southwest that was threatening damage. From the industrial field the reports of large output and heavy orders continue to be received. In some branches, notably in the manufacture of automobiles, the manufacturers are running overtime. The iron and steel industry is flourishing beyond almost every previous record. Prices for finished products have been steadily advancing, but the rush of orders shows little indication of diminishing. The railroads are buying freely of rolling stock and track equipment. During the past week the Pennsylvania Railroad ordered 10,000 steel cars. New business in steel rails is fair, and orders for quite heavy tonnages are known to be pending. The lumber trade is reported to be in excellent shape, and all kinds of building materials are in demand. Reports from the railroads continue to improve, and already in many portions of the West there is serious complaint over the shortage of cars. Collections as a rule are reported to be excellent and money is in more active demand throughout the West. Business troubles are not particularly numerous, nor are they very serious. Failures for the week ended Nov. 18, as reported by *Bradstreet's*, were 232, as compared with 221 the previous week, 273 in the same week of 1908, 265 in 1907, 212 in 1906 and 224 in 1905.

THE COPPER MARKET.

The past week has been an important one in the copper trade. There was heavy buying both by consumers and by speculators, the former frightened by the advancing prices and the latter eager to get in on the ground floor and reap the advantages that are expected to follow the merging of the big interests. The result of the week's trading has been an advance in the local market of about ⅝ cent per pound. The sales within the past fortnight are estimated to be 120,000,000 lb. In the meantime production is being pushed to record proportions, and actual melting is not materially increased. The accumulation of copper continues, although the ownership is changing. On Nov. 22 the first authentic—although not entirely official—statement concerning the great merger was given out. It is practically admitted that the Amalgamated, Cole-Ryan and Guggenheim properties, together with some South American and Canadian companies, will be included in the consolidations. The capitalization of the companies involved is in the neighborhood of $670,000,000, and they have an annual output of copper of about 765,000,000 lb, or something more than one-half of the American production of refined copper. None of the Michigan properties is expected to join in the merger, and the Phelps-Dodge properties are not included, although it is not expected that these will be operated with any definite antagonism to the allied interests. The decision in regard to the Standard Oil Company has caused some discussion in connection with the copper merger, but has not checked the negotiations. Exports continue to be heavy. Up to and including Nov. 22 the shipments for the month amounted to 16,946 tons. The daily call on the Metal Exchange Nov. 22 quoted standard copper as follows:

	Bid.	Asked.	Settling price.
Spot	13.25	13.60	....
November	13.25	13.60	13.42½
December	13.25	13.60	13.42½
January	13.25	13.60	13.42½
February	13.25	13.60	13.42½
March	13.25	13.60	13.42½

The London prices Nov. 22 were as follows:

	Noon.			Close.		
	£	s	d	£	s	d
Standard copper, spot	60	2	6	60	5	0
Standard copper, futures	*61	5	0	61	7	6
Market	Weak			Steady		
Sales of spot				2,000 tons		
Sales of futures				2,000 tons		

*Futures were 15s. higher than here quoted.

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard	13.45			12.12½		
London, spot	£64	2	6	£54	12	6
London, futures	64	17	6	55	10	0
London, best selected	67	15	0	59	0	0

ALUMINUM COMPANY SELLING WIRE.—The recent business of the Aluminum Company of America in the line of wire for transmission purposes is reported to have been very heavy. This is especially true in regard to the orders from Canada. It is given out that one Canadian order has been placed for 1,500,000 lb. of half-inch aluminum wire, to be delivered as quickly as it can be manufactured. This is to be used for the distribution of the energy generated at Niagara Falls throughout the province of Ontario, and is part of a general plan to induce American manufacturers to locate in Canada. The contract referred to was placed by the Hydro-Electric Company of Ontario, and will amount to about $400,000. The wire will be drawn in the company's plants in Niagara Falls and Montreal. The Canadian commission intends to regulate the rates for energy and deliver it to manufacturing concerns at the lowest possible figure. Taken altogether the Aluminum Company of America has had a very prosperous year, and its output in 1909 will exceed that of 1908 by a considerable amount. In 1908 the company produced 8,200,000 lb. of aluminum. Prices remain about the same, the crude metal selling from 20 to 23 cents per pound.

DENVER GAS & ELECTRIC COMPANY.—Negotiations are on foot through which the Denver Gas & Electric Company expects to purchase the Denver City Steam Heating Company. The stockholders of the latter corporation will meet Nov. 22 for the purpose of voting upon the question of sale. If the transfer is made, it is the purpose of the purchaser to erect a new plant and enter actively into the business of furnishing steam heat to the business section of Denver. The payment for the Steam Heating Company will, it is stated, be made by an addition to the new stock which the reorganized Denver Gas & Electric Light Company was about to issue. The new company will have authorized issues of $10,000,000 in capital stock and $25,000,000 in bonds. The plan of reorganization has been outlined heretofore in these columns.

GENERAL ELECTRIC COMPANY'S SALES.—The gross sales of the General Electric Company for the month of October were slightly less than $4,750,000, which is the heaviest amount for any month of the current year. This is at the rate of about $55,000,000 per year and compares with total sales of $44,540,676 for the company's fiscal year which ended Jan. 31, 1909. The average operating cost for the past five years has been 84 per cent, and on this basis the net earnings should be almost $9,000,000, enough to pay the 8-per cent dividend on the $65,178,800 capital stock and have a handsome surplus.

CONSOLIDATED RESERVOIR & POWER COMPANY.—Surveys have been completed, near Banning, Cal., for the construction of a conduit for the Consolidated Reservoir & Power Company, which will bring the water from Whitewater River, eight miles, to a point near Banning. The intake will be at an elevation of 7000 ft., water being drawn from the three streams which make the South Fork of the Whitewater. There will be half a mile of pressure pipe between the cement conduit and the power house.

ROCKLAND RAILROAD COMPANY.—Construction work will be commenced early in the spring upon the line of the Rockland Railroad Company, which proposes to connect Tappan, Suffern, Stony Point and Nyack, N. Y. The line will build about 40 miles of track. Contracts for the work have not been let.

HYDROELECTRIC DEVELOPMENT ON MANISTEE RIVER.—A franchise has been granted to the Manistee County Electric Company, of Manistee, Mich., to construct dams in the Manistee River for the purpose of developing water-power. Permission is given by the Board of Supervisors of the county to erect no less than six dams at High Bridge, Junction and other places varying in height from 15 to 45 ft. Electrical energy is to be generated, and the city of Manistee and other municipalities in the county shall have the first right to purchase it, and, following them, private business concerns. It is provided that customers in the county taking 100 hp or less shall pay not to exceed 90 per cent of the prices charged outside customers. Local customers taking in excess of 100 hp shall pay not more than 95 per cent of the price charged outside the county. The compensation for the grant is $100, and it is stipulated that one of the dams shall be begun within two years and put in operation within four years. There is no time limit to the life of the franchise. Mr. Clyde J. Holmes was active, on behalf of the company, in procuring the franchise.

NEW STEEL MILLS TO USE ELECTRICITY.—The McClintic-Marshall Construction Company, of Pittsburgh, manufacturer of structural steel, has purchased a tract of ground comprising 50 acres in Indiana Harbor, Ind., at the southern end of Lake Michigan, near the boundary of the city of Chicago. The company will erect a structural steel plant on this site at once, and it is said that the new establishment will be in readiness for manufacturing operations within a year. When the plant is completed, its capacity will be from 60,000 to 70,000 tons of structural steel annually. One thousand or more men will be given employment, and a considerable use will be made of electricity for light and power. From Lebanon, Pa., comes the announcement that the managers of the American Iron & Steel Manufacturing Company have sanctioned the erection at that place of a steel billet mill without delay. It is reported that the plant with its machinery will involve an expenditure of more than $500,000. An extensive use will be made of electricity for operating motors as well as for lighting.

TELEPHONE DISPATCHING ON SANTA FÉ RAILWAY.—A system of telephone train dispatching has recently been completed and put into service by the Atchison, Topeka & Santa Fé Railroad Company on its Illinois division between Chillicothe, Ill., and Dearborn Street, Chicago, a distance of 134 miles. On this circuit the dispatcher is located at Chillicothe. There are 30 way stations in which telephones and selective equipment have been installed. With the completion of this circuit trains on this road running out of Chicago are handled by the telephone as far as Newton, Kan. A total of 660 miles is covered from Chicago to Newton. There are on this section a total of 170 way stations, all equipped with standard Western Electric Company telephone train dispatching apparatus and Gill bridging selectors. Each of these stations has direct communication over the telephone with the dispatcher of its division.

J. G. WHITE & COMPANY.—J. G. White & Company, New York, have been awarded the contract for the double tracking of the Albany Southern Railroad between Rensselaer and Kinderhook Lake, N. Y., as well as the straightening of curves and the rehabilitation of a large amount of the present track of that company. In addition to the operation of its third-rail electric road between Albany and Hudson, N. Y., the railroad company furnishes electric light to the following towns: Rensselaer, East Greenbush, East Schodack, Nassau, North Chatham, Niverville, Valatic, Kinderhook, Stuyvesant Falls and Stottville. It also owns and operates gas plants in Hudson and Rensselaer, N. Y. The above properties are under the management of J. G. White & Company.

SOUTHERN POWER COMPANY'S PLANS.—Surveys are now being made and rights of way secured for a system of trolley lines from Greensboro, N. C., by way of Salisbury and Charlotte, to Spartansburg and Greenville, S. C. The route practically parallels the transmission lines of the Southern Power Company, and it is understood that the power company is backing the project. W. S. Lee, Jr., vice-president of the power company, as well as J. B. and B. N. Duke, are interested in the new electric lines.

RATEAU TURBINES FOR STEEL WORKS.—The Lukens Iron & Steel Company, Coatesville, Pa., will install a complete 750-kw, 250-volt, direct-current Rateau-Smoot low-pressure turbo-generator set, including a Rateau generator and condenser. The Ball & Wood Company will furnish the turbine and the generator. The same company has recently closed a contract with the Maryland Steel Company, Sparrow Point, Md., for two 750-kw, 250-volt, direct-current generators to be direct connected to Rateau-Smoot low-pressure turbines. In each case the units will operate on exhaust steam.

WHITNEY COMPANY.—It is said that J. B. Duke and a party of capitalists associated with him in the Southern Power Company visited the Whitney Company's plant on the Yadkin River, near Salisbury, N. C., one day last week and made a thorough inspection of the development. This visit has given rise to rumors that the Southern Power Company is contemplating taking over the smaller plant. The Whitney Company has been in the hands of a receiver since Feb. 3, 1908, but until recently work has been continued on the dam.

MARKETS FOR ELECTRICAL MACHINERY.—An American consul in Latin America has forwarded to the Bureau of Manufactures the name and address of a business man who has recently been granted a concession for the establishment of an electric light plant. A consul in Canada has reported that a power company within his district will soon begin the erection of a 25,000-hp hydroelectric plant. The Bureau filing numbers of the above reports are 4144 and 4149.

NEW MONTANA POWER PLANT.—Plans are being matured for the construction of a hydroelectric plant at Thompson Falls, on the Missouri River, in Montana. It is expected that enough power will be secured to furnish all the energy needed in the Cœur d'Alene mining district. This comes in competition with the Washington Water Power Company, of Spokane. The new company expects to be able to furnish energy at one-half the present rates.

GARWOOD ELECTRIC COMPANY.—The demand for small motors is reported by the Garwood Electric Company to be so unusually heavy that prices have recently been advanced 5 per cent, and in spite of this it is found necessary to operate the plant both night and day. Officials of the company say that the books are full of orders and that inquiries are coming in from all parts of the country.

AWARD OF CANADIAN CONTRACT.—The Canadian Light & Power Company has awarded a contract for three 5000-kw, 2200-volt generators, and for transformers to step up to 44,000 volts, to the Allis-Chalmers-Bullock Company. The contract for the corresponding switchboard was given to the Canadian Westinghouse Company.

IDAHO POWER & TRANSMISSION COMPANY.—The Idaho Power & Transmission Company has purchased the electric light and power plants at Rexburgh, Sugar City, Teton City and St. Anthony which belonged to Hodgens Brothers, of Butte, Mont. This sale includes the water system at St. Anthony.

ANOTHER BRITISH ELECTRICAL COMPANY OPENS CANADIAN OFFICES.—The Lancashire Dynamo & Motor Company, Trafford Park, Manchester, has sent a representative to Canada and opened a permanent office in the Peterkin Buildings, Toronto.

1000-CP TUNGSTEN LAMPS.—The Electrical Accessaries Company, 1135 Broadway, New York, has recently received a consignment of high candle-power Just tungsten lamps from Germany. These lamps are of 600 and 1000 cp, and are the largest ever imported.

BUENOS AIRES EXPORTERS' AGENCY.—Charles Altschul, formerly connected with Lamm Bros. & Company, exporters, Antwerp, Belgium, has established an office at Buenos Aires, where he will act as an agent for foreign firms.

TUNGSTEN LAMP COMPANY.—It is reported that a company is in process of formation with strong financial backing, for the manufacture of tungsten lamps of a type which has met with much commercial success in Europe.

LUMBERING ELECTRIC PLANT.—The Brooks-Scanlon Company, of Vancouver, B. C., will replace steam with electric power at its camp on Gordon Pasha Lakes, and purposes to install a hydroelectric plant at Powell River.

STUDEBAKER DENVER BUILDING.—The Studebaker Company is building a six-story building in Denver for automobile sales and show rooms. Two floors will be devoted entirely to electric machines.

Financial Intelligence.

THE WEEK IN WALL STREET.

While it cannot be said that the money market has ceased to play an important figure in the stock market, there were developments last week involving important American corporations which practically overshadowed the financial situation. The week was a notable one for big happenings. The purchase of the control of the Western Union Telegraph Company by the American Telephone & Telegraph Company, the declaration of the 300 per cent dividend by Wells, Fargo & Company, the announcement of the new financial plan of the Missouri Pacific Railroad Company, and, most important of all, the decision adverse to the Standard Oil Company, all had distinct effects upon the stock market. The first three of these important happenings affected principally the question of refinancing; the Wells, Fargo dividend liberated a large amount of cash, while the Missouri Pacific financing will require about $30,000,000 in money. If the great copper merger is put through upon the plans which are now reported, there will be a heavy demand for money. Any unusual demand will serve to depress prices and lessen trading. The decision of the Standard Oil case is entirely apart from these other matters. The immediate effect was to start active liquidation, and the market on Nov. 22 showed very heavy transactions, with a general recession in prices. The question which seemed to touch the traders was whether this decision might not be so farreaching as to cover other important corporations of similar organization, and transacting business under similar methods. Such great concerns as the United States Steel Corporation, the American Tobacco Company, the United States Rubber Company and the American Telephone & Telegraph Company are all organized for the purpose of controlling and economizing business in their various lines, and, as far as an ordinary observer can see, they are very little different in purpose and operation from the Standard Oil Company. It is not remarkable, therefore, that such a decision as that rendered by the United States Court in Missouri should be disquieting to the holders of the stocks of these great merger corporations. The financial situation, taken as a whole, is better than it was last week. Money rates have remained about on the same level, and there has been no especial stringency. Quotations Nov. 22 were: call, 4¼ @ 5 per cent; 90 days, 4¾ @ 5 per cent. The quotations in the table are those of the close, Nov. 22.

NEW YORK.

	Nov. 15.	Nov. 22.	Shares sold.		Nov. 15.	Nov. 22.	Shares sold.
All. Ch.....	15⅝	15	4,900	Int.-Met.,pfd.	55⅜	54¾	66,020
All.-Ch. pfd..	54⅞	54¼	19,345	Mackay Cos..	93¼	94	9,100
Amal. Cop....	94	92	563,200	MackayC.,pfd.	75*	75⅞	2,100
Am. D. T....	20½*	20½*	.....	Man. Elev...	140¼*	140	298
Am. Loc.....	62½	61½	3,738	Met. St. Ry..	27	23*	766
Am. Loc.,pfd.	116*	115	100	N.Y.&N.J.Tel.	139¼*	139¼*	.....
Am. Tel. & C.	85*	83*	600	Steel, com....	90⅞	88⅜	446,250
Am. T. & T..	142⅞	142⅝	92,370	Steel, pfd....	126⅜	125	4,600
B. R. T.....	76⅜	77¾	32,095	W. U. T.....	83¼	77⅝	72,250
Gen. Elec....	162*	162	5,840	West'h., com.	85½	85⅞	6,400
Int.-Met.,com.	23	22½	145,387	West'h., pfd..	134½*	134½*	.....

PHILADELPHIA.

	Nov. 15.	Nov. 22.		Nov. 15.	Nov. 22.
Am. Rys.....	45	45¼	Phila. Elec.....	13⅛	13
Elec. Co. of A.....	12⅜*	12⅜*	Phila. R. T.....	26¾	26½
Elec. St. B'ty.....	58½	58	Phila. Trac.....	89*	89*
E. S. B'ty, pfd.....	30*	30*	Union Trac.....	52¾	52½

CHICAGO.

	Nov. 15.	Nov. 22.		Nov. 15.	Nov. 22.
Chi. City Ry.....	180*	180*	Chi. Tel. Co.....	136	136*
Chi. Rs., Ser. 1.....	108*	100*	Met. El., com.....	17*	17*
Chi. Rs., Ser. 2.....	33½	32	Met. El., pfd.....	52½*	53
Com. Edison.....	119	119*	Nat'l Carbon.....	97	97
Chi. Subways.....	6½	6	Nat'l Car., pfd.....	120*	124*

BOSTON.

	Nov. 15.	Nov. 22.		Nov. 15.	Nov. 22.
Am. T. & T.....	142½	142⅞	Mex. Tel.....	3*	3*
Cum. Tel.....	146*	147*	Mex. Tel., pfd.....	6*	6*
Edison E. Ill.....	250	251*	N. E. Tel.....	134¾	135
Gen. Elec.....	162*	162¼	W. T. & T.....	11¼	12
Mass. E. Ry.....	16¼	16*	W. T. & T., pfd.....	89*	90
Mass. E. R., pfd....	80	80			

* Last price quoted.
Shares sold are for week of Nov. 15 to Nov. 20.

TELEPHONE MERGER IN OHIO.—It is announced at Columbus, Ohio, that preliminary plans have been perfected which will insure the merging of practically all the independent telephone companies in Ohio. A plan has been drafted by a sub-committee of 15, which represents about 100 independent companies. It is expected that this merger will include all of the companies excepting those whose control was recently purchased by James F. Brailey, Jr., of Toledo. Judge Lewis Brucker, of Mansfield, Ohio, who is chairman of the subcommittee, says that ample finances have been obtained to bring about the merger and to insure an excellent service after the companies come together. A new company will be formed which will issue stock in exchange for the outstanding stock of the subsidiary companies.

AMERICAN GAS COMPANY.—The American Gas Company, Philadelphia, has purchased a majority of the stock of the Suburban Gas Company, of Philadelphia; the Jenkintown & Cheltenham Gas Company, the Huntindon Valley Electric Light & Power Company, the North Penn Gas Company, and the Coastville Gas Company. It is proposed to merge all of these properties with the People's Gas Company, of Pottstown, which is already owned by the American company. The new properties will be amply financed, and there will be extensive improvements and developments. The American Gas Company already owns and operates 14 gas and electric plants in various parts of the country. It has outstanding $1,700,000 of stock and $1,500,000 in bonds.

SOUTHERN COLORADO POWER COMPANY.—A number of creditors of the Southern Colorado Power Company are making a fight in court against the foreclosure sale of the property. They ask that the present receiver, Frank P. Read, be removed, and that another receiver be appointed who is not a bondholder in the company. The matter will come up for decision Dec. 1. Plans are on foot for the reorganization of the company, if it is purchased by the bondholders, by the incorporation of a new concern wtih a capital stock of $5,000,000, which is expected to be sufficient to pay the present bondholders and to leave $1,000,000 to be expended in improving the plants and transmission lines of the company.

ALUMINUM COMPANY'S BIG STOCK DIVIDEND.—In the last issue of the *Electrical World* it was announced that the Aluminum Company of America had filed notice of an increase of capital stock to $20,000,000, together with the statement of an official of the company that no plans had been made for the expenditure of the proceeds of the stock for extensions or improvements. It is now announced that $16,000,000 of the new stock will be distributed as a 500 per cent stock dividend on the $3,200,000 of common stock. The last available report of the company, Dec. 31, 1907, showed total assets of $13,190,568, with no outstanding bonds. In 1904 the holders of common stock received a stock dividend of 100 per cent.

WHITE INVESTING COMPANY.—The White Investing Company, which has been formed for the purchase and sale of bonds and securities and for financing, developing and operating approved industrial enterprises, especially mining, and those based on natural resources, has established its main office at 43 Exchange Place, New York. The officers of the company are: William F. White, president; John A. Lovell, William B. Ridgely and Calvin B. Humphrey, vice-presidents; T. S. Huff, secretary and assistant treasurer. A. A. Blow is head of the department of mines.

UTICA SOUTHERN RAILWAY EXTENSION.—The Public Service Commission of the Second District has given permission to the Utica Southern Railroad Company to issue $628,000 of new bonds and to increase its issue of preferred stock $400,000. The proceeds of these new issues will be used to build an extension from Hamilton, via Earlville and Shelburne to Norwich, a distance of 27 miles, and to complete the line from Clinton to Hamilton. A branch will also be built between Deansboro and Waterville.

BOSTON & WORCESTER STREET RAILWAY BONDS.—Application has been made to the Railroad Commission of Massachusetts by the Boston & Worcester Street Railway Company for permission to issue $500,000 additional stock to be sold to the present shareholders at par. This will make the total capitalization of the company $2,525,000. The proceeds of the new issue will be used for extensions, a new car house and additional rolling stock.

POUGHKEEPSIE LIGHT, HEAT & POWER COMPANY.—James A. Hutchinson, of Boston, has purchased from the Poughkeepsie Light, Heat & Power Company $100,000 of 5 per cent bonds. This issue is the remainder of the bonds authorized under the present mortgage. The Poughkeepsie company does the entire gas, electric light and power business of Poughkeepsie and operates under a perpetual franchise. The bonds are being offered to the public at par and interest.

THIRD AVENUE REORGANIZATION PLAN.—A committee of stockholders of the Third Avenue Railroad Company have framed a plan of reorganization, which differs widely from the bondholders' plan, turned down by the Public Service Commission in September. The plan reduces the total outstanding securities of the company from $58,560,000 to $52,000,000, this being done at the commission's suggestion. The plan also calls for an assessment of 50 per cent upon the stockholders and subsequently the scaling down of the holdings 25 per cent. This would mean $8,000,000 in cash, and the reduction of the outstanding stock to $12,000,000. The stockholders are, however, to be compensated for the assessment by being given $9,000,000 4-per cent first mortgage bonds. The holders of the present $5,000,000 first mortgage bonds will be given $6,000,000 of the new first mortgage bonds, and the holders of the present issue of $37,000,000 consolidated bonds will be given $25,000,000 consolidated bonds.

NEW YORK CONDUIT COMPANIES.—The Public Service Commission of the First District of New York has given out the reports for the year 1908 of the Consolidated Telegraph & Electrical Subway Company and of the Empire City Subway Company, Ltd. The former of these companies shows assets of $14,131,658, and the latter $11,768,317. These reports disclose the ownership of the companies. The Consolidated Telegraph & Electrical Subway Company furnishes conduits for all of the high-power wires for light and power, and, out of the 18,750 shares of stock, the New York Edison Company owns 15,160 shares. The Empire City Company, which furnishes conduits for the low potential wires (telephone and telegraph) practically belongs to the New York Telephone Company, this concern owning 38,025 out of a total of 43,240 shares.

MILLIKEN BROS. RECEIVERSHIP ENDED.—The United States District Court has granted a motion to dismiss the petition in bankruptcy filed against Milliken Bros., Inc., in June, 1907. The receivers are directed to return the property and assets to the corporation. In making this order the company is instructed that all non-assenting creditors have their claims secured in a satisfactory manner or paid; that all of the liabilities of the receivers on outstanding contracts or judgments for damages be secured, and that the fees of the receivers and their counsel be agreed upon and paid. During their tenure the receivers have collected more than $6,500,000, and have expended nearly $6,000,000. They have completed successfully 66 contracts which were on hand when they took charge, and have completed 275 other contracts.

INTERNATIONAL STEAM PUMP COMPANY.—The statement of the earnings of the International Steam Pump Company for the seven months ended Oct. 31, 1909, shows net earnings, including those of the Power & Mining Machinery Company, of $852,236, as compared wtih $647,306 for the same period last year. This is an increase of approximately 30 per cent. President Guggenheim, of the company, says that orders taken in recent months are equal to the maximum capacity of the plant.

ELECTRICAL CONSOLIDATION AT MURFREESBORO, TENN.—A deal has been made between the Davis & Elam Electric Light Company and the City Gas & Electric Company, the former company taking over the properties of the latter. During the competition within the past six months the price of electricity has been reduced as low as 3 cents per kw-hour. Since the deal has been consummated the price has advanced to 12 cents.

MEXICAN NORTHERN POWER COMPANY.—At a meeting of the bondholders of the Mexican Northern Power Company held in Montreal, Can., on Nov. 17, authority was given for an increase of the bond issue from $7,500,000 to $10,000,000. The capital stock is also to be increased from $10,000,000 to $15,000,000.

DIVIDENDS.

Brooklyn Rapid Transit Company, quarterly, 1 per cent, payable Jan. 1.

General Electric Company, quarterly, 2 per cent, payable Jan. 15.

Kansas City Railway & Light Company, preferred, quarterly, 1¼ per cent, payable Nov. 30.

Philadelphia Company, quarterly 1½ per cent, payable Dec. 15.

Philadelphia Electric Company, quarterly, 1½ per cent, payable Dec. 15.

Rochester Railway & Light Company, preferred, quarterly 1¼ per cent, payable Dec. 1.

St. Joseph Railway, Light, Heat & Power Company, quarterly, ½ per cent, payable Dec. 1.

REPORT OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Changes.	Expenses.
American Light & Traction Company:					
October, 1909	$313,847	$8,865	$304,982	.....	.....
October, 1908	278,220	4,000	274,220	.....	.....
American Telephone & Telegraph Company:					
Ten months ended October 31, 1909	27,779,879	2,095,191	25,684,687	$6.018,789	$19,665,898
Ten months ended October 31, 1908	24,594,552	1,736,061	22,858,491	6,380,746	16,477,745
Blackstone Valley Gas & Electric Company:					
September, 1909	83,997	41,441	42,556	.....	18,560
September, 1908	70,876	37,056	33,820	.....	.....
Columbus, Ga., Electric Co:					
September, 1909	31,604	18,329	13,275	11,474	1,800
September, 1908	30,304	15,658	14,645	11,687	2,958
Dallas, Tex., Electric Corporation:					
September, 1909	107,569	74,512	33,057	21,775	7,948
September, 1908	95,842	63,097	32,762	24,623	4,805
East St. Louis & Suburban Company:					
October, 1909	191,775	93,206	98,569	49,490	48,079
October, 1908	178,644	90,803	87,841	48,826	38,015
Edison Electric Illuminating Company, Brockton, Mass:					
September, 1909	22,364	13,510	8,853	3,159	5,694
September, 1908	16,471	8,951	7,519	2,851	4,668
Electric Securities Company:					
Year ended October 31, 1909	368,501	217,600	150,901	.....	.....
Year ended October 31, 1908	349,014	208,195	140,819	.....	.....
El Paso Electric Company:					
September, 1909	50,500	29,873	20,626	8,184	12,441
September, 1908	43,828	33,338	10,489	7,133	3,356
Galveston-Houston Electric Company:					
September, 1909	100,837	56,363	44,474	20,075	24,399
September, 1908	91,790	46,620	45,170	17,450	27,719
Keystone Telephone Company:					
October, 1909	91,560	45,544	46,016	32,768	13,248
October, 1908	88,819	43,420	45,399	34,482	10,917
Minneapolis General Electric Company:					
September, 1909	94,012	38,858	55,154	31,528	23,626
September, 1908	81,898	34,412	47,485	32,310	15,175
Northern Texas Electric Company:					
September, 1909	104,828	57,785	47,042	17,189	29,852
September, 1908	88,189	49,315	38,874	15,215	23,658
Puget Sound Electric Railway:					
September, 1909	179,955	107,604	72,350	44,452	27,897
September, 1908	143,121	90,243	52,877	39,464	13,413
Savannah Electric Company:					
September, 1909	49,523	32,030	17,492	15,778	1,714
September, 1908	48,403	27,661	20,741	15,886	4,855
Seattle Electric Company:					
September, 1909	568,494	305,341	263,152	95,221	167,931
September, 1908	385,945	209,951	175,993	86,001	89,992
Tampa Electric Company:					
September, 1909	47,108	27,253	19,855	3,865	15,990
September, 1908	43,356	26,704	16,651	3,787	12,863
United Railways Company of St. Louis:					
October, 1909	1,039,267	627,968	411,299	232,267	179,032
October, 1908	949,914	572,326	377,588	233,845	143,743

GENERAL NEWS

Construction News.

FORT PAYNE, ALA.—The Fort Payne Fuel & Iron Company is contemplating the installation of an electric light plant to supply electricity to manufacturing plants. E. C. Drew is president.

GURLEY, ALA.—The Gurley Light & Power Company, recently incorporated, has been granted a franchise to erect an electric light plant and has secured a contract to furnish electricity to light the streets of the town.

PARAGOULD, ARK.—The Independent Rural Telephone Company, of Marmaduke, Ark., has applied to the City Council for a new franchise which will enable the company to install a switchboard in Paragould. Under its present franchise the company is only permitted to operate one station in the city.

ALTURAS, CAL.—Plans have been prepared by I. W. Gibbins, of Alturas, for filing water rights for a hydroelectric power plant on Silver Creek, in the Warner Mountains. The proposed plant will be capable of developing 4000 hp.

BAGBY, CAL.—Extensive improvements are contemplated by the Lead Mining & Manufacturing Company to its plant in the near future, which will include the installation of power transmission machinery, Faber d'Faure furnaces and other equipment.

BANNING, CAL.—Surveys have been completed by the Consolidated Reservoir & Power Company for conduit which is to bring water from Whitewater River to a point near Banning. The intake at an elevation of 7000 ft. will draw water from three streams which make up the south fork of Whitewater. Beginning at the intake eight miles of cement pipe will be built and a half mile of pressure pipe to a point where the first power house will be located for generating electricity. H. E. Moore and George I. Lamy, of Los Angeles, Cal.; W. B. Scarborough, of Monrovia, Cal., and R. B. Sheldon, of Riverside, Cal., are interested in the enterprise.

LOS ANGELES, CAL.—The Southern Pacific Company is reported to be considering substituting electricity for steam power for switching and yard work in Los Angeles County, especially at the harbor.

OAKLAND, CAL.—The Oakland Traction Company has been granted a franchise to operate an electric railway along Grand Avenue, for which the company paid the city the sum of $500.

OAKLAND, CAL.—Application has been made to the Board of Supervisors by D. U. Toffelmire, representing the United Power Company, for a franchise to furnish electricity in Alameda County in competition with the Oakland Gas Light & Heat Company. The franchise is for a term of 50 years to be offered to the highest bidder.

RED BLUFF, CAL.—The Board of Supervisors has awarded a franchise to the Sacramento Valley Power Company to erect transmission lines in Tehama County.

SAN DIEGO, CAL.—The City Council has granted a franchise to G. W. Pursell to construct and maintain an electric railway in San Diego. The proposed railway will extend from San Diego to Escondido.

SAN DIEGO, CAL.—The Board of Park Commissioners is considering the selection of a design for the electric fountain to be erected on the park plaza, to cost $10,000, funds for which were donated by Louis J. Wilde, president of the American National Bank.

SANTA ROSA, CAL.—The Board of Supervisors has advertised for sale the franchise applied for by A. Sbarboro and A. E. Sbarboro for an extension of the lines of the Cloverdale Lighting Company throughout northern Sonoma County. It is proposed to furnish electricity to light several small towns and also for a number of business enterprises.

SOUTH PASADENA, CAL.—Plans have been completed for the lighting system, which the residents of Fletcher, Electric and Bushnell avenues propose to install, at a cost of from $1,200 to $1,500. The plans include the installation of 20 ornamental poles, on which will be placed two lamps, on each of the three avenues.

VALLEJO, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 24 for installing an electric passenger elevator at the Navy Yard, Mare Island, Cal., plans and specifications for which may be obtained on application to the above bureau or to the commandant of the Navy Yard, Mare Island. R. C. Hollyday is chief of bureau.

BOULDER, COL.—The City Council has voted to appropriate $40,000 for the construction of a hydroelectric power plant in connection with the city water system, in accordance with plans prepared by Prof. H. S. Evans, of the State University, about a year ago. The city engineer has been instructed to make surveys, and it is probable that definite steps will be taken at an early date toward the construction of a plant. The project includes utilizing a pipe line which supplies the city with water from Silver Lake for the generation of power. At one point on the line a fall of 1000 ft. could be obtained, and with the present amount of water used by the city 11,000 hp could be developed. With the growth of the city and the increasing use of water, the generating power would greatly increase, as the pipe line has a maximum capacity of 20 cu. ft. An impulse was given to this matter by the adjuciation for water rights, whereby the city was given an unconditional decree of 20 cu. ft. for power purposes, but unless the city proceeds, these rights may be forfeited to some private concern willing to act at once.

EVANS, COL.—Prepartions are being made by the Home Light & Power Company, of Greeley, to supply electricity in Evans. Electrical energy for operating the system is purchased from the Northern Colorado Power Company. The Home company is extending a 6600-volt feeder line four miles to supply the Evans service. The right-of-way to be secured for these lines is intended ultimately to be utilized for the 4000-volt lines of the Northern Colorado Power Company in completing a loop from Greeley through La Salle, Ft. Lupton, Platteville and Brighton and back to the generating station at Lafayette.

GREELEY, COL.—Work has begun on the underground-cable system to be established at Greeley by the Colorado Telephone Company, to be connected with its new exchange building, also under construction. The cost of the work is estimated at $25,000.

TRINIDAD, COL.—Plans for reorganizing the Southern Colorado Power Company, which operates the street railway, gas, electric and power systems in Trinidad and the surrounding towns, have been completed and, it is said, that the company will be taken out of the receiver's hands next month. It is understood that a new company will be formed, capitalized at $5,000,000, which will pay off the bonded indebtedness of the old company, and will spend $1,000,000 in improving and extending its system. The property will probably be sold at public auction about Dec. 15 and will be bid in by representatives of the stockholders. Plans have been prepared for enlarging the plant and rebuilding the portion destroyed by fire some months ago. The company also furnishes electricity to the large coal and coke corporations in Southern Colorado.

NEW BRITAIN, CONN.—The Landers, Frary & Clark Company is constructing a large electric power plant which when completed will furnish electricity to operate its entire plant. The main power house will be 104 ft. x 63 ft. and one story high, and the boiler house 87 ft. x 72 ft. The equipment of the plant will include a 1500-hp McIntosh-Seymour cross-compound engine direct connected to 1000-kw, alternating-current generator. An engine will also be installed for auxiliary purposes. Seven 250-hp Manning boilers have been installed. The remainder of the equipment has not yet been decided upon. It is expected to have the plant completed by February, 1910.

NEW HAVEN, CONN.—In the bid submitted to the City Council by the United Illuminating Company, for furnishing electricity for street lighting for a term of four years, the company offers to supply from 625 to 700 lamps at the rate of 20 cents per night per lamp, or $73 per lamp per year; over 700 lamps at 19½ cents each per night. The New Haven Gas Light Company submitted a bid offering to supply gas lamps at $21.80 per lamp per year, of which there are 1300.

SOUTH COVENTRY, CONN.—The Rockville-Willimantic Lighting Company is contemplating the construction of a transformer station on "The Flats," near South Coventry, for the distribution of electricity for lamps and motors in South Coventry.

FORT DU PONT, DEL.—Contracts have been awarded by Lieut. E. A. Stockton, Jr., constructing quartermaster, for construction of electric lighting system at Fort Du Pont, as follows: For inside work to A. D. Granger Company, of New York, N. Y., for $5,073; outside work to McKay Engineering Company, of Baltimore, Md., for $5,369; for supplying apparatus, etc., to the Westinghouse Electric & Manufacturing Company, Pittsburgh., Pa., for $2,490.

WILMINGTON, DEL.—Plans are being considered for establishing municipal conduits for the purpose of placing all wires underground. It is now proposed that the city purchase the conduits already installed by the local telephone companies and rent them with others to be installed to companies maintaining wires. The Street and Sewer Commission is now securing data for the cost of installation and maintenance and the rentals to be charged for space in conduits.

JACKSON, GA.—The Schott Engineering Company, of Chicago, is building the power-transmission lines from the power plant in the Ocmulgee River to Macon, Ga. and other points; steel towers are used costing $500 each, and being set 500 feet apart. The first section of the line will extend from the power plant to Macon.

LA FAYETTE, GA.—An election will be held Dec. 15 to vote on the proposition to issue $12,000 in bonds, the proceeds to be used for the construction of an electric light plant.

MACON, GA.—Work will soon commence on construction of power transmission lines of the Central Georgie Power Company. The first line will be run from the power plant on the Ocmulgee River, near Jackson, Ga., to Macon, Ga., via Bibb and Forsyth, Ga. It has been stated that a line will also be built from Forsyth to Griffin, Ga., and thence to Atlanta, Ga.

MOULTRIE, GA.—The city of Moultrie will receive bids until Nov. 29 for a 100-kw generator direct connected to a four-valve automatic engine, switchboard, arc lamps, etc. Specifications can be obtained by addressing the mayor. W. D. Scott is Mayor.

GRANGEVILLE, IDAHO.—S. C. McDaniels is erecting a new independent telephone system, including about 100 miles of line, into the mining districts of the South Fork country.

REXBURG, IDAHO.—The Idaho Power & Transportation Company, of Idaho Falls, has purchased the electric light and power plants at Rexburg, Sugar City, Teton City and St. Anthony, which belonged to the Hodgens Brothers, of Butte, Mont. The deal also includes the water system of St. Anthony. The headquarters of the company will be retained at Idaho Falls, with a local manager in each town. It is expected that the service will be improved under the new management.

TWIN FALLS, IDAHO.—The publicity committee, appointed by the citizens of Twin Falls to investigate the question of locating and securing a power site at Clear Lakes for the purpose of turning the same over to the County of Twin Falls to be utilized to develop power to operate an electric light plant and other purposes, has submitted its report recommending the county to take over the power rights secured. The committee has offered to turn over the power site secured to the County of Twin Falls for the actual amount paid out to hold the site. The members of the committee are willing to organize and incorporate a holding company to take over the power site and plant until the citizens can organize in districts and be ready to take over said property. It is also proposed to construct an electric railway in connection with the project and to furnish electricity for manufacturing purposes throughout the entire county, as well as for City of Twin Falls. W. P. Guthrie, H. O. Milner and Thomas Costello are members of the committee.

CHICAGO HEIGHTS, ILL.—The Chicago Heights & Eastern Electric Railroad Company has applied to the County Board for a 75-year franchise to construct an electric railway from Chicago Heights east to the State line.

EAST ST. LOUIS, ILL.—The City Council has awarded the contract for lighting the streets of the city for a term of 10 years to the Consumers' Heat, Light & Power Company at the rate of $70 per lamp per year.

EVANSTON, ILL.—The old generating station of the Evanston Electric Illuminating Company, which was absorbed by the North Shore Electric Company, was damaged by fire on Nov. 12. The building adjoins the new Clark Street substation of the North Shore company and was being dismantled at the time of the fire. Considerable equipment was still in the station, including the arc lamp switchboard, which was damaged by water, leaving the city without street-lighting service for one night. All commercial service had been transferred to the new plant. The damage is estimated at about $10,000.

WATERTOWN, ILL.—The Village Board is reported to have granted a 25-year franchise to the United Light & Power Company to furnish electricity for lamps in Watertown.

BROOK, IND.—The Commissioners of Newton County have granted to Cragg Brothers a franchise to erect and operate transmission lines on the county roads between Brook, Morocco and Foreman. The Cragg Brothers, is is said, are in the market for material for construction of the line.

GREENFIELD, IND.—Perry J. Freeman, of Richmond, Stokes Jackson and other local capitalists are organizing a company to build a traction line from Greenfield to Pendleton, a distance of 16 miles. Application for franchises to enter Greenfield and Pendleton have been filed. The company will also petition the Commissioners of Hancock and Madison counties for rights of way across public highways. It is proposed to build the greater part of the line on a private right of way.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company expects to occupy its new power station on West Washington Street by Dec. 1. It is understood that the company expects to abandon its power station on South Jersey Street when the new station is completed. The original plans of the company were to use the new station for electrical service and to supply heat from the South Jersey Street station.

JASONVILLE, IND.—The Indiana Electric Transmission Company has awarded the contract for laying six miles of pipe line in Jasonville, to Larkin Brothers, of Dayton, Ohio.

LAFAYETTE, IND.—The Commissioners of Tippecanoe County have granted the Indiana & Northern Traction Company a 55-year franchise for the construction of an electric railway from the battleground north to the county. Under the terms of the franchise the company is obliged to complete the railway within two years. The headquarters of the company are located at Marion, Ind. The company was incorporated in 1903 with a capital stock of $300,000. George A. H. Shielder, A. H. Shielder, B. F. Burk, E. H. Neal, of Marion, Ind., and George Breed, of Philadelphia, Pa., are interested in the enterprise.

SOUTH BEND, IND.—Preparations are being made by the Northern Indiana Railway Company for improvements to its power plant in South Bend, which will involve an expenditure of about $12,000.

STAUNTON, IND.—The Terre Haute, Indianapolis & Eastern Traction Company is erecting wires along the Staunton road from the company's feed wires on the National road to this city. The company has secured a franchise to furnish electricity to light the streets and for domestic purposes in Staunton. The traction company has purchased the Stewart electric plant and will improve the distributing system.

ADEL, IA.—At a special election held recently the citizens voted to grant the Adel City Railway Company a franchise to construct and operate a street and interurban railway in the town of Adel.

ANAMOSA, IA.—Negotiations have been closed whereby A. E. Anderson, of Chicago, Ill., has purchased the plant and holdings of the Anamosa Electric Light & Power Company in Anamosa, owned by Zinn Brothers, of Oxford Junction, Ia., and Park Chamberlain and George L. Schoonover, of Anamosa, Ia. W. C. Hill, of Chicago, Ill., will be general manager of the new company.

FORT DODGE, IA.—Plans are being considered by the Fort Dodge, Des Moines & Southern Railroad Company for the construction of a large power plant which will be located at Brushy. It is said that the company will commence work on the construction of the plant as soon as the Supreme Court renders its decision in regard to the crossing rights at Gypsum over the Illinois Central Railroad tracks. The Fort Dodge, Des Moines and Southern Railroad Company has secured options on the Crooked Creek Railroad, which extends from Webster City to Lehigh, which it will take over if a favorable decision is given. It is proposed to equip the last-named railroad for electrical operation.

LEON, IA.—Preparations are being made by the Leon Electric Company for the construction of a new power house, to cost about $9,000. Samuel C. Johnston is manager of the company.

MARSHALLTOWN, IA.—A special election will be held Nov. 29 to vote on the proposition to grant three public-service franchises to run for a term of 25 years, application for which has been made for by H. W. Darling and Louis H. Schroeder. One is for electric service, another for gas supply and a third for a street railway system.

ERIE, KAN.—J. C. Denious, city clerk, writes that bids for the construction of the proposed municipal electric light plant and water works system will be opened about Dec. 15. Bonds to the amount of $50,000 were voted for the project Nov. 2. Burns & McDonnell, Scarrett Building, Kansas City, Mo., are engineers.

HILL CITY, KAN.—The construction of a municipal electric light plant in Hill City is under consideration.

MURRAY, KY.—Bids will be received by Joseph T. Parker, city clerk, until Dec. 17 for the purchase of $23,000 water works and electric light bonds.

ALEXANDRIA, LA.—J. P. Turregaus, Mayor, writes that bids will be received until Dec. 20 for extensions and improvements to the municipal electric light plant and water works system, for which bonds to the amount of $40,000 were voted. I. W. Sylvester is city engineer.

LEWISTON, MAINE.—The Union Water Power Company has purchased the water power at Clarks Rips, about eight miles above this city. It is reported that the company will construct a new dam and install an electric power plant which will develop 11,000 hp. Electricity generated at the plant will be used to operate the mills in Lewiston.

ROCKVILLE, MD.—The Town Council has granted the Potomac Power & Electric Company, of Washington, D. C., a franchise to erect transmission lines along certain streets in Rockville to furnish electricity for lamps, residences, business places, etc. The ordinance provides that the company shall erect its lines on Montgomery Avenue and Commerce Street, the main thoroughfares of the town, from the extreme eastern limits to western limits within 60 days. The company's lines already extend to the eastern limits of the town. The streets of Rockville are lighted by the municipal lighting plant.

BOSTON, MASS.—The Boston & Worcester Street Railway Company has applied to the State Railroad Commission for permission to increase its capital stock from $2,025,000 to not exceeding $2,525,000, to be offered to stockholders at par, the proceeds to be used to construct and equip a railway extension and car house and for additional rolling stock.

CHICOPEE, MASS.—The Electric Light Commissioners have awarded the contract for new generating machinery and switchboard for the municipal electric light to the General Electric Company, of Schenectady, N. Y., bids for which were opened on Oct. 11.

FRANKLIN, MASS.—The Union Electric Company has notified the Board of Selectmen that the company will furnish an all-night schedule for street lighting from now until Feb. 1, without extra cost, as the town has no available funds for this purpose. The present contract was made under a moonlight schedule. It is expected that the town will make a sufficient appropriation to cover the expense of an all-night schedule at the town meeting to be held in next March.

MILFORD, MASS.—The Selectmen have granted the Worcester & Blackstone Valley Street Railway Company a franchise to erect a transmission line from a point near the power station to the Worcester line, near Millbury Junction.

SPRINGFIELD, MASS.—The City Council has voted to authorize the street lighting committee to make arrangements with the United Electric Light Company to erect a large sign, between 80 and 90 ft. long and about 3 ft. wide, at the South End bridge. The sign will bear the inscription, "Welcome to Springfield." The company agrees to erect the sign at its own expense and will furnish electricity for lighting the same at the same rate charged for other service to the city, which will make the cost of maintenance about $400 per year. Agitation for a similar sign at the North End bridge is already under way.

MANISTEE, MICH.—The Manistee County Hydraulic Company has accepted the franchise granted by the Board of Supervisors of Manistee County, and will commence work immediately on what is called the "Junction Dam," located about 20 miles east of Manistee. The dam is to be 43 ft. high and will develop 3800 hp.

KALAMAZOO, MICH.—The Grand Rapids Electric Railway Company has applied to the City Council for a 30-year franchise to construct and operate an electric railway in the city limits, with the consideration that all its lines are to be completed within one year from the time the ordinance is passed. The company proposes to construct an electric railway from Bay City to Grand Rapids and thence to Kalamazoo; also to extend the railway from Kalamazoo to Battle Creek, thence to Coldwater, Montgomery and Camden. Jerry W. Boynton is president of the company.

ANOKA, MINN.—The Council has granted the Anoka-Minneapolis Suburban Railway Promotion Company a franchise to construct an electric railway in Anoka. C. J. Swenson, of Minneapolis, Minn., is interested in the project.

BRECKENRIDGE, MINN.—The Wahpeton & Breckenridge Street Railway Company is reported to be considering the construction of a power plant. It is said that a gas engine and gas producer plant may be included in the equipment.

MINNEAPOLIS, MINN.—Arrangements are being made with the Pillsbury-Washburn Flour Mills Company for the construction of a large central power plant adjoining "A" mill in Southeastern Minneapolis, at a cost of $225,000. It is said that about $100,000 will be spent this year and the plant completed in 1910.

MINNEAPOLIS, MINN.—The officials of the Northern Heating & Electric Company have notified Mayor James C. Haynes that they may accept the tentative franchise, which provides for a revocable license until the plant is built, allowing three years for that work, when the franchise proper goes into effect for a definite term. L. L. Brooks, of St. Paul, Minn., is president and James Eddy, of Chicago, Ill., secretary of the company.

WHITE BEAR, MINN.—The Washington County Light & Power Company, of Stillwater, Minn., which recently purchased the property of the White Bear Electric Company, has commenced work on improvements to be made to the White Bear system. The station will, in the future, be known as Station C. The local steam plant will be abandoned and electricity for operating the system will be supplied from Riverside, near Somerset, Wis. The White Bear system will provide electricity for lamps for the cottages along the shore of the lake, including Mahtomedi, Lave View and Dellwood. It is also expected that the service will be extended to the other side of the lake toward White Bear. The new pole line is expected to be completed this fall.

NATCHEZ, MISS.—Additional equipment is being installed in the power station of the Southern Railway & Light Company, including a 300-kw alternating-current generator to furnish electricity for lighting service and a 300-kw direct-current machine for street railway service. A 500-hp boiler has been installed.

PINEBUR, MISS.—The Walworth & Neville Manufacturing Company, of Pinebur, Miss., wishes to purchase at once a second-hand, direct-current dynamo that is guaranteed to furnish electricity for 250 16-cp lamps. Machine to be given a test on the work before final acceptance.

BUFFALO, MO.—It is reported that the Big Naungua Power Company is contemplating the construction of a hydroelectric plant in Buffalo, Mo.

KANSAS CITY, MO.—William M. Hall has withdrawn his application for a general franchise to furnish electricity in Kansas City to compete with the Kansas City Electric Light Company and will only ask for an ordinance that will protect his properties by granting a permit confirming the privileges he now has to supply electricity in the neighborhood of his building at Ninth and Walnut streets.

ST. LOUIS, MO.—The Foresight Investment Company is reported to be contemplating the construction of an electric light plant and cold storage plant near Forsythe Boulevard and Cornet Avenue. James J. Quinn is president and George Lewis, secretary, 608 Liggett Building, St. Louis, Mo.

HARLOWTON, MONT.—The Harlowton Light & Water Company completed its first year Nov. 13, and in extending greeting to its customers hopes for the same cordial relations during the coming year that have existed during the past year.

KALISPELL, MONT.—The Northern Idaho & Montana Power Company has acquired the plant of the Big Fork Water Company at Kalispell, Mont., and will enlarge and improve the system.

MISSOULA, MONT.—Plans are being considered by Senator E. Donlon, of Missoula, for the construction of a large hydroelectric plant at Thompson Falls, to furnish electricity in the Coeur D'Alene's mining district in competition with the Washington Water Power Company, of Spokane, Wash. Senator Donlan has acquired the necessary water rights and the site for the plant and will proceed with the construction of the plant as soon as the weather will permit. It is claimed that the new plant can furnish electricity to the local properties at half the cost of the present rate.

LINCOLN, NEB.—The special committee appointed to investigate the question of installing ornamental street lamps on O Street has decided to authorize the Lincoln Traction Company to secure samples of poles for inspection. The traction company has offered to pay toward the cost of the poles the amount it would cost them to erect iron poles the same distance. Nothing as yet has been done toward securing the necessary means to defray the extra cost for the system, which will amount to about $800 to each block, exclusive of wiring. It is expected that the business men in the district benefited will pay the additional cost. It is understood that the municipal electric lighting plant is taxed to its utmost capacity at present. Both private lighting companies, it is said, are ready to submit propositions for furnishing electricity for the additional service.

GOLDFIELD, NEVADA.—Work is soon to commence on a large power plant in Mono County, to supply power for an electric railroad from Coaldale to Bodie, to connect with the Tonopah and Goldfield Railroad, and also to furnish electricity for the mining camps of Southern Nevada and California. The water for the power plants will be taken from Silver Lake, and will have a drop of 1200 feet. About 33,000 hp. will be developed.

ROSWELL, N. MEX.—The Roswell Commercial Club, it is said, will investigate the feasibility of a plan proposed for developing water power in the mountains, west of Roswell, to be utilized to generate electricity for distribution in the vicinity of Roswell to be used for pumping water for irrigation purposes.

BUFFALO, N. Y.—The Buffalo & Williamsville Electric Railway Company is reported to be in the market for a 200-kw rotary converter and three 100-kw transformers.

CAMILLUS, N. Y.—The Town Board has granted a franchise to Moritz Mayer, of Syracuse, N. Y., to erect a transmission line from the substation of Niagara Falls transmission lines at Solvay to the Village of Camillus. The main purpose of the line is to furnish electricity for lamps and motors for the Camillus Cutlery Works, of which Mr. Mayer is manager. Electrical service will also be furnished to any resident of the town. Negotiations are now under way between Mr. Mayer and the Syracuse Lighting Company in regard to furnishing electricity for the service.

ISLIP, N. Y.—The Board of Trade is interested in a project to bring about the construction of an electric railway across the island. It is proposed to have the railway extend from the railroad station at Islip through to Smithtown or Stony Brook Harbor, and possibly to Port Jefferson.

MONROE, N. Y.—We are informed that the Orange & Rockland Electric Company is in the market for a direct-connected unit of from 500 to 1000-kw, 60-cycle, three-phase, 2200 or 2300 volts. R. W. Smith is president and manager.

NEWPORT, N. Y.—The Newport Electric Light & Power Company has made arrangements to sell $50,000 of the $75,000 first mortgage bonds which the company was recently granted authority to issue by Public Service Commission, Second District. The proceeds to be used for extensions to its property. The company owns valuable water rights on West Canada Creek, in Herkimer County, which, it is estimated, is capable of developing more than 2500 hp. At present less than 500 hp is being used. The present plans include the construction of a new dam and power house and the installation of an alternating-current system, and extension of transmission lines to Cold Brook, Poland and the surrounding country within a radius of from 15 to 20 miles, where franchises and municipal contracts have been secured. Work will commence on these improvements early in 1910.

NEW YORK, N. Y.—The Public Service Commission, First District, has approved the franchise granted the South Shore Traction Company by the Board of Estimate to construct a railway in Queens and run cars across the Queensboro Bridge.

NEW YORK, N. Y.—Announcement has been made that the Rockland Railroad Company, which proposes to construct an electric railway to connect Tappan, Suffern, Stony Point and Nyack, will be ready to begin work on construction of the railway early in the spring. No contracts have been let for the work. The railway will be about 40 miles in length. Headquarters of the company are at 165 Broadway, New York, N. Y. Arthur C. Miller is second vice-president and general manager.

OSSINING, N. Y.—The Public Service Commission, Second District, has granted the Northern Westchester Lighting Company permission to issue $125,000 in bonds, to be sold at not less than 90 per cent of their par value, the proceeds to be used to discharge indebtedness of the company incurred in making additions and betterments to its plant and distributing system.

ROCHESTER, N. Y.—The Public Service Commission, Second District, has given its approval of the franchise granted by the Village of Middleport to the Buffalo, Lockport & Rochester Railway Company. The approval is given on the condition the company shall submit the plans and specifications to the commission for approval before it does any work on the construction of its transmission lines. The Commission also gave its approval of the contract between the Niagara, Lockport & Ontario Power Company and the Buffalo, Lockport & Rochester Railway Company, giving the first-named company the privilege of using the excess capacity of the transmission line for the purpose of transmitting and selling eleectricity not utilized by the railway company to other parties and corporations in the district through which the transmission line extends.

UTICA, N. Y.—The Utica Southern Railway Company has been authorized by the Public Service Commission, Second District, to build an extension of its railway from Hamilton, via Earlville and Shelburne,

through Norwich, a distance of 27 miles. The company had previously been granted permission to construct an electric railway from Clinton to Hamilton, with a branch between Deansboro and Waterville, 27 miles in length. It is also authorized to execute a mortgage and to issue bonds to the amount of $628,000, par value, the proceeds to be used for constructing and equipping the extension from Hamilton to Norwich, and also to issue $400,000 in preferred capital stock, on condition that the proceeds be used for construction and equipment of the extension.

APEX, N. C.—The town has granted a 20-year franchise to A. J. Martin to build and to operate an electric plant in this place. The plant is to be installed by Jan. 1, 1910. It is probable that electricity will also be supplied to industrial plants.

DANBURY, N. C.—A charter has been granted to the North Carolina Traction Company to build a system of electric railways radiating from Danbury, developing surrounding timber lands, etc. H. P. McKnight, of Southern Pines, is the principal stockholder; associated with him are: E. Hillman, of Aberdeen, N. C., and W. C. Reflert, of Harrisburg, Pa., and E. L. Krafft, of Indianapolis, Ind. The company is capitalized at $2,000,000.

FAYETTEVILLE, N. C.—The Raleigh & Southport Railway Company is planning to build an extension of its railway from Fayetteville to Hope Mills, N. C., a distance of seven miles. John A. Mills, of Raleigh, N. C., is president and general manager.

GREENSBORO, N. C.—Surveys are now being made and rights-of-way secured for the proposed electric railway system to extend from Greensboro, N. C., to Spartansburg and Greenville, S. C., via Salisbury and Charlotte, N. C. The route practically parallels the transmission lines of the Southern Power Company, and it is understood that the power company is interested in the project. W. S. Lee, Jr., vice-president of the Southern Power Company; J. B. and B. N. Duke are interested in the proposed railway.

ROXBORO, N. C.—The Town Council has let the contract for installing an electric-light system in Roxboro to J. Maxwell, of the General Electric Company, at Baltimore, Md.

WAYNESVILLE, N. C.—Plans are being considered for the construction of a hydroelectric power plant in connection with an electric railway proposition. It is said that 600 hp will be developed for electrical transmission. W. B. Ferguson, Hugh A. Love, of Waynesville, Ga., and Mr. McCormick, of St. Paul, Minn., are reported to be interested in the project.

COLUMBUS, OHIO.—Plans have been prepared by Howard & Merriam, architects, Capital Trust Building, Columbus, Ohio, for a power plant to be erected on the infirmary ground in connection with the tuberculosis hospital building.

NEW LISBON, OHIO.—It is reported that the electric light plant of the New Lisbon Gas Company was destroyed by fire on Nov. 14.

TOLEDO, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 20, for the installation of a conduit and wiring system and a standard clock system in the United States post office, Toledo, Ohio, in accordance with drawings and specifications, copies of which may be obtained at the above office, or at the office of the superintendent of construction, Toledo, Ohio. James Knox Taylor is supervising architect.

ALTUS, OKLA.—Plans are being prepared for extensions to the municipal electric system, which will involve an expenditure of about $35,000. An election will soon be called to vote on the proposition.

BEAVER, OKLA.—Plans are being made by the Beaver Valley & Northwestern Railroad Company to commence work on the construction of its proposed railway from Gage to Hooker, via Beaver, before the first of the year. The section from Hooker to Beaver, 40 miles in length, will be constructed first. J. M. Kerns, of Beaver, Okla., is general manager.

DUSTIN, OKLA.—The City of Dustin is contemplating the installation of a municipal electric light plant and would like to receive estimates on cost of installation of the same. For further information address F. P. Hicks, town clerk.

LAIDLAW, ORE.—H. H. Humphreys, of Kennewick, Wash., is reported to have secured options on all available land at Aubrey Falls and secured contract for the sale of the Aubrey Falls site and D. F. Nichols water power on the Deschutes River. It is said that work will commence on the project within 90 days.

PORTLAND, ORE.—The Home Telephone Company is planning to erect three new exchanges on the East Side and greatly increase its system, which will involve an expenditure of $100,000. The exchanges will be erected at Sellwood, Mount Tabor and St. Johns.

IRWIN, PA.—The capital stock of the Irwin & Hermoine Street Railway Company has been increased from $100,000 to $125,000.

JOHNSTOWN, PA.—The Cambria Steel Company, it is said, has decided to install a 5000-hp steam turbine, with alternating-current generator, exciter, etc., to furnish electricity to operate the machinery in its mills.

MERCER, PA.—The Iron City Engineering Company, of Pittsburgh, Pa., has applied to the City Council for a franchise to construct and operate an electric light plant and street railway system in Mercer.

NANTICOKE, PA.—Bids will be received at the office of the Borough Secretary until Dec. 14 for lighting the streets of the borough for terms of one, three or five years from May 1, 1910, in accordance with specifications on file at the above office. Clem J. Knoll is secretary of Town Council.

PEN ARGYLE, PA.—Orders have been placed by the Slate Belt Electric Street Railway Company with the Electric Storage Battery Company, of Philadelphia, Pa., for a 400-amp. storage battery. The company has recently placed a contract for a new 150-kva, 2300-volt, 60-cycle, three-phase Crocker-Wheeler alternator, direct connected to a Porter Allen engine, to furnish electricity for lamps. The entire lighting system is being changed to 2300-volts, three-phase. J. T. Hambleton is general manager.

PHILADELPHIA, PA.—The Hero Manufacturing Company, it is reported, will install an electric generating unit and motors in its factory.

PHILADELPHIA, PA.—The Philadelphia Electric Company was the only company which submitted bids for lighting streets of the city for the coming year. The prices are the same as paid under the present contract, which will amount to about $1,182,000. For electric lamps in West Philadelphia and in North Philadelphia, north of Allegheny Avenue, the price was 28 cents per lamp per night, and for the remainder of the city, south of Allegheny Avenue, 27 cents per lamp per night. The only exception to these bids was 25 cents for lamps on poles owned by the city and connected with city service cables, and 29 cents for lamps on city poles connected with the company's cables. The number of lamps operated this year throughout the city is 11,807, but next year the number will be materially increased.

PITTSBURGH, PA.—Charter extensions have been taken out by the West Penn Railways Company for extensions of its system from Greensburg to New Alexandria, Pa., a distance of seven miles; from Uniontown to Leisenring, seven miles; from Hunker to West Newton, 10 miles, and from West Newton to Scott Haven, five miles.

STROUDSBURG, PA.—Preparations are being made by the Stroudsburg & Water Gap Street Railway Company for the construction of a new power station, work on which will begin at once.

WYOMISSING, PA.—Application will soon be made for a charter for an electric railway to be known as the Berks County Traction Company, which will extend from Wyomissing to Strausstown, and thence to Fredericksburg, Pa., a distance of about 35 miles. W. C. Riffert, Lewis Crater, A. S. Seidel and Henry Fay are interested in the project.

YORK, PA.—The Edison Electric Light Company is installing a 525-kw engine and generator at its local plant to be used as an auxiliary in case of emergencies and during low-water periods, which handicap the York Haven water and power plant.

FLORENCE, S. C.—A franchise has been granted by the City Council to John L. Barringer, P. A. Willcox, William J. Brown and S. S. Ingman for the construction of an electric railway on all of the streets in the city. It is proposed to build a street railway throughout the city, which will be extended to Darlington, via the Muse Bridge on Black Creek, near which an amusement park will be established.

LEESVILLE, S. C.—The Brodie Light & Power Company is constructing an electric light plant in Leesville.

ROCK HILL, S. C.—The Town Council has rejected three propositions made by the Philadelphia owners of the present city lighting plant, one to sell for $145,000, and the other two for short and long-term contracts, and has voted for municipal ownership. A petition for a $35,000-bond issue for lighting purposes was ordered circulated.

ABERDEEN, S. D.—The Aberdeen Street Railway Company has been granted a 20-year franchise to construct and operate a street railway in Aberdeen.

FORT PIERRE, S. D.—The question of establishing an electric light plant in Fort Pierre is under consideration. It is said that if the City Council can secure a satisfactory proposition from private parties to install an electric light plant a franchise will be granted, otherwise it is proposed to install a municipal plant.

MILBANK, S. D.—An electric light plant is being installed in Milbank, S. D., by Oscar Claussen, consulting engineer, St. Paul, Minn., the equipment of which will include a Muenzel producer gas engine and gas producer plant furnished by the Minneapolis Steel & Machinery Company, of Minneapolis, Minn.

BRISTOL, TENN.—It is reported that the Norfolk & Western Railway Company contemplates the installation of an electric light plant, to cost $3,000. C. S. Churchill, of Roanoke, Va., is chief engineer.

MEMPHIS, TENN.—Contracts have been placed for rails and ties by the Lakeview Traction Company for its proposed railway from Memphis to Lakeview, a distance of 11 miles. The company is contemplating the use of motor cars outside of Memphis. The railway will eventually be extended to Clarksdale, Miss.; another section will run from Memphis to Jackson, via Covington, and a third from Memphis to Collierville.

MURFREESBORO, TENN.—A deal has been consummated between Davis & Elam, proprietors of the Davis & Elam Electric Light Company, and the City Gas & Electric Company, whereby the first-named company has purchased the plant and holdings of the City company. The two companies have been competing with each other for the past six months, with the result of reducing the price of electricity to three cents per kw-hour. Since the consummation of the deal the price has been ad-

vanced to 12 cents per kw-hour. The City Gas & Electric Company had a 10-year contract with the city for lighting the city. It is reported that the consideration was $40,000.

CALVERT, TEX.—The capital stock of the Calvert Water, Ice & Electric Company has been increased from $50,000 to $100,000.

MARATHON, TEX.—Plans are being considered for the installation of an electric light plant and ice factory in connection with the rubber works in Marathon. Mr. Staten is reported to be interested in the project.

MOUNT PLEASANT, TEX.—The City Council has granted M. Greenspun, of Mt. Pleasant, a franchise to erect another electric light plant in this city. An ice plant will also be built in connection with the electric plant, making two electric and ice plants in Mt. Pleasant.

FORT DOUGLAS, UTAH.—Contracts have been awarded for the construction of an electric lighting system at Fort Douglas as follows: For wiring certain buildings and furnishing and installing fixtures, to the Meteor Electric Company, of Salt Lake City, Utah, for $9,418; installing transformers and erecting transmission lines, etc., to the Salt Lake City Supply Company, for $11,749; furnishing and installing equipment and wattmeters for buildings, to the F. E. Newberry Electric Company, of St. Louis, Mo., for $4,065; construction of transformer station, to the Salt Lake Electric Supply Company, for $2,950. Lieut. K. P. Williams is constructing quartermaster.

SALT LAKE CITY, UTAH.—The Salt Lake & Los Angeles Railway Company has applied to the County Commissioners for a 50-year franchise to operate a railway from Salt Lake City to Saltair for the purpose of double-tracking and equipping its railway to be operated by electricity.

HAMPTON, VA.—Announcement is made that the Capital City Beach Corporation, which holds extensive water-front property above Buckroe Beach, has perfected arrangements with the Newport News & Old Point Electric Railway Company to extend its electric lines to its property.

PULASKI, VA.—The Town of Pulaski would like to receive prices on new and second-hand guaranteed machinery with full dimensions and descriptions as follows: one 200-hp tubular boiler complete; one 150-hp horizontal engine, suitable for direct connection to 100-kw alternator, 275 r.p.m.; one 100-kw, 3-phase, 60-cycle alternator; six 5-kw, 60-cycle transformers; one switchboard suitable for above alternator. All prices on second-hand machinery must give full history of machines, together with description and dimensions. For further information address S. S. Wall, Pulaski, Va., superintendent.

RICHMOND, VA.—The council committee on water has adopted the plans presented by E. W. Trafford, consulting engineer, for erection of transmission line from the new electric plant to the new pump house on the upper river to furnish electricity to operate the new pumps recently installed. Bids have been called for the erection of the line.

BURBANK, WASH.—Contracts have been awarded by the Burbank Power & Water Company for the construction of a new pipe line and distributing canal at Five Mile Rapids on the Snake River. The contract for the distributing canal was awarded to Otto Hanson, of Kennewick, Wash., for $30,000. The cost of the entire work is estimated at $50,000. James D. Hodge, of Seattle, Wash., is president.

CHESAW, WASH.—Preparations are being made by the Apex Mining Company for the installation of a power plant in its mine. It is said that another gasoline engine, compressor and an outfit of power drills will be purchased.

NORTH YAKIMA, WASH.—The Union Gap Irrigation Company is enlarging its canal for the purpose of establishing an electric generating plant. It is said that machinery and equipment for the plant will be purchased through local concerns.

POMEROY, WASH.—C. L. MacKenzie, of Colfax, Wash., has secured the controlling interest in the Tucannon Power Company. Plans are being made for constructing a new barrel flume to carry the water on the Tucannon.

SEATTLE, WASH.—Contracts will soon be awarded by the Seattle-Tacoma Short Line for the construction of an electric interurban railway between Seattle and Tacoma, to run along the shore between the two cities. E. J. Felt will have charge of construction of the road.

SPOKANE, WASH.—It is reported that negotiations have been completed between the Washington Water Power Company and the Interstate Mining Company, whereby the power company will furnish electricity to operate the mines of the Interstate Mining Company, located west of the Hercules mine.

WALLA WALLA, WASH.—The Washington-Oregon Traction Company will soon award contracts for the construction of its proposed electric railway between Walla Walla and Pendleton, Ore., a distance of 53 miles. The power plant will be located in Walla Walla. The company expects also to furnish electricity for lamps and motors. S. Drumhiller is president and W. S. Matthias, acting general manager.

WALLA WALLA, WASH.—We are informed that the Washington Traction Company expects to commence work on its proposed electric railway, which is to extend from Dayton, Wallula, Waitsburg, Dixie, Walla Walla, Milton and Pasco, 143 miles in length, in the near future. As yet a site has not been selected for the power house. The repair shops will be located in Walla Walla. Gilbert Hunt, of Walla Walla, is president.

WALLA WALLA, WASH.—The Northwestern Gas & Electric Company has applied to the City Council for an extension of its franchises in Walla Walla, covering its electric light and power service, street railway system and gas service. The extension is asked to make the present franchise correspond with the $5,000,000 bond issue, which is to run for 25 years. The company, it is said, is contemplating the construction of electric railways to Wallowa, Ore., and Dayton, Wash. It is understood that the latter will be the equipping of the Northern Pacific Railroad from Walla Walla to Dayton for electrical operation.

BLACKSVILLE, W. VA.—The Blacksville Street Railway Company has purchased a site in Blacksville, on which, it is said, the company will erect a power plant and car barns for the proposed new street railway, which, according to present plans, will extend from Blacksburg to Waynesburg, thence to Marianna and Pittsburgh. All the rights of way between Waynesburg and Blacksville have been secured.

MARINETTE, WIS.—If present plans mature another large hydro-electric power plant will be erected on the Menominee River within another year. It is proposed to construct a dam capable of developing 6000 hp. A fiber mill is also to be erected, which will utilize part of the power developed and remainder will be sold for manufacturing purposes in Marinette and Menominee. Land needed for the overflow has been secured. Harry J. Brown is interested in the project.

BASIN CITY, WYO.—The City Council has decided to call a special election to vote on the proposition to purchase the electric plant of the Wyoming Electric Light & Power Company, to be owned and operated by the municipality.

CALGARY, ALTA., CAN.—The ratepayers have passed the by-law authorizing extensions and improvements to the local street railway, which will involve an expenditure of $40,000.

NELSON, B. C., CAN.—The Bulls River Falls Power & Light Company, which is constructing a large power plant in the Fort Steel district, proposes to furnish electricity for lamps and motors to all towns in the Pass country from Michel, and eastward to Moyie. The construction of an electric railway from the falls to the Town of Jaffray is also contemplated, which may eventually be extended to Fort Steel and Cranbrook.

VANCOUVER, B. C., CAN.—The Brooks Scanlon Lumber Company is contemplating replacing the steam donkey engines with electrical power for logging on its property at Gordon Pasha Lakes, near the head water of Jarvis inlet. It is said that the company proposes to erect a power plant on Powell River. It is expected that logging by electricity will soon become general throughout British Columbia.

SWAMP RIVER, MAN., CAN.—The ratepayers have voted in favor of the bylaw to issue $15,000 in bonds, the proceeds to be used to purchase a lighting plant, fire engine, etc.

GALT, ONT., CAN.—The report submitted by Engineer E. B. Merrill, of Toronto, to the Council, on the value of the Galt Gas & Electric Light Company's electric-lighting plant, which the company offered to sell to the town for $63,000, exclusive of the water power on the Grand River, states that the amount asked by the company is based on the original cost of the plant, but states that after allowing for depreciation tion the present value is $44,000, and that if the plant were to be operated in connection with the Hydro-Electric Power Commission project, the value for this purpose would be $35,000.

INGERSOLL, ONT., CAN.—The Town Council is taking action in the direction of establishing a plant for the distribution of Niagara power. A by-law is to be submitted to the ratepayers at the January municipal election authorizing the establishment of a distribution plant for hydro-electric power. The by-law is similar to the one voted upon by the other municipalities three years ago. At that time the town voted on a by-law to acquire the existing plant of the Ingersoll Power & Light Company, which was defeated. Two years ago Mayor Sutherland advocated arbitration proceedings with the company and later a by-law was submitted to the people providing for the acquirement of the company's plant for the sum of $50,000, but this was also rejected. In the report submitted by Engineer Yates, of the Hydro-Electric Power Commission, the cost for a civil power distribution plant is estimated at $26,000, and an additional cost of $26,000 for a lighting service, making a total of $52,000 for a new plant.

PORT ARTHUR, ONT., CAN.—At a recent election the ratepayers voted to accept the agreement made with the Ontario Hydro-Electric Commission for electrical power.

TRENTON, ONT., CAN.—The by-law submitted to the ratepayers on November 15, for the purpose of ratifying an agreement transferring from the town its water-power rights to the Trenton Electric & Water Company, was defeated.

TORONTO, ONT., CAN.—The Hydro-Electric Commission has awarded a contract to the American Aluminum Company of America, of Pittsburgh. Pa., for 1,500,000 lb. of ½-in. aluminum wire to be used in connection with the distribution of electricity generated at Niagara Falls throughout the Province of Ontario. The contract will amount to about $400,000.

COTEAU LANDING, QUE., CAN.—The International Waterways Commission presented to the Dominion Parliament on Nov. 16 a recommendation approving of the application of the Cedar Rapids Manufacturing & Power Company to construct power works on the north side of

the Cedar Rapids in Soulanges County near Coteau Landing, about 30 miles above Montreal, and that the company be given authority to divert 56,000 cu. ft. of water per second from the St. Lawrence River at that point.

MONTREAL, QUE., CAN.—The City Council on Nov. 15 decided to postpone its proposed offer to the Montreal Light, Heat & Power Company of $75 per arc lamp per annum for a five-year contract, and a by-law to raise $2,000,000 for the establishment of a municipal lighting plant will be submitted to a vote of the ratepayers on Dec. 21.

LA BARCA, MEX.—A company has been formed in La Barca for the purpose of acquiring the local horse car lines, which will be equipped to be operated by electricity. Application has been made to the State Government for a concession for an electric traction system. The principal car line, which is about three miles in length, connects the town and the National Railways station. Electrical energy for operating the system will be secured from the Guanajuato Power & Electric Company, of Guanajuato, Mex. Fructuoso Castellanos and Luis Navarrete are interested in the project.

New Industrial Companies.

THE ACME GAS & ELECTRIC FIXTURE COMPANY, of New York, N. Y., has been chartered with a capital stock of $30,000 by S. Wallach, S. H. Shiminsky, of New York, N. Y., and H. L. Adelman, of Brooklyn, N. Y. The company proposes to manufacture electric fixtures, gas and electric appliances, chandeliers, etc.

THE BAUER NON-COLLAPSIBLE WHEEL COMPANY, of New York, N. Y., has been incorporated with a capital stock of $150,000 by Matthew Haupt, of Edgewater, N. J.; W. J. Bauer, of New York, N. Y., and J. F. Bolton, of Fort Lee, N. J. The company proposes to manufacture motors, engines, vehicles, wheels, cars, etc.

THE B. & L. AUTO LAMP COMPANY, of New York, N. Y., has been incorporated by Vera Backer, Alexander Backer, of New York, N. Y., and Leon Lapis, of New York, N. Y. The company is capitalized at $3,400 and proposes to manufacture lamps and generators for automobiles, etc.

THE COMPOUND PROPELLER & BOAT COMPANY, of South Berwick, Maine, has been incorporated with a capital stock of $100,000 to deal in boats, engines, motors, etc. The officers of the company are: W. Thompson, president; F. A. Hobbs, treasurer and clerk, all of South Berwick, Maine.

THE CUMBERLAND & SALEM CONSTRUCTION COMPANY, of Vineland, N. J., has filed articles of incorporation, with a capital stock of $10,000, for the purpose of constructing street railways. The incorporators are: George H. Stevenson, Frank Parvin, Thomas Coggey, all of Vineland, N. J.; Benjamin F. Patterson, of Brooklyn, N. Y., and Herbert C. Barlett, of Vineland, N. J.

THE FULTON ELECTRICAL CONTRACTING COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 to do a general electrical engineering and contracting business, etc. The incorporators are: Howard L. Judson, Joseph L. Martin and Lester J. Mack, all of New York, N. Y.

THE GREYHOUND MOTOR WORKS, of Buffalo, N. Y., have been incorporated with a capital stock of $100,000 to manufacture automobile vehicles, motors, engines, motor cycles, etc., by Fred P. Fox, W. C. Overman, John W. Van Allen, all of Buffalo, N. Y.

THE A. HOUSTON COMPANY, of Jersey City, N. J., has filed articles of incorporation with a capital stock of $25,000 for the purpose of doing a general mechanical and electrical engineering business. The incorporators are: A. Houston, M. A. Houston, of Jersey City, N. J., and J. B. Spear, of Paterson, N. J.

THE HOOKER ELECTRO CHEMICAL COMPANY, of Niagara Falls, N. Y., has been incorporated with a capital stock of $3,750,000. The directors of the company are: Franklin Remington, Michael Gavin, 2d, Percy K. Hilton, of New York, N. Y.; George E. Veile and Albert H. Hooker, of Niagara Falls, N. Y. The company proposes to manufacture chemical preparations and compounds.

THE H. P. KEANE COMPANY, of Atlanta, Ga., has been chartered with a capital stock of $10,000 by H. P. Keane and J. J. Batterman. The company proposes to deal in electrical apparatus.

THE LUCIUS ENGINEERING COMPANY, of Camden, N. J., has been chartered with a capital stock of $75,000 by A. V. Murray, H. G. Elliott and A. Martin, all of Camden, N. J. The company proposes to do a general engineering, contracting and construction business.

THE MARINE ELECTRICAL COMPANY, of Lorain, Ohio, has been incorporated with a capital stock of $25,000 for the purpose of designing and installing steamship electrical appliances and devices. The company will also manufacture an electrical sounding device operated from the engineer's room by which water levels of the various ballast tanks can be ascertained by simply pushing a button, which was invented by A. B. Walton. A. H. Babcock is president of the company and J. M. Jones, secretary and treasurer.

THE E. M. PECK COMPANY, of Portchester, N. Y., has been chartered by Earl W. Peck, James P. Travers and Richard P. Lydon, all of New York, N. Y. The company is capitalized at $30,000 and proposes to deal in inventions, patents and patent-rights, etc.

New Incorporations.

GROVELAND, GA.—The Magnolia Spring Company has applied for a charter for the purpose of establishing a street railway in Groveland, and also asks for the privilege of erecting power plants. The company is capitalized at $5,000 and the incorporators are: W. Elabee, M. E. Carter, L. Banks, E. A. Proctor, D. B. Warnell and W. C. Perkins.

ALLEGANY, N. Y.—The Allegany Telephone Company has been organized to operate a telephone system in Allegany County. The company is capitalized at $10,000, and the directors are: Robert E. Lang, George J. Fisk and John B. White, of Belfast.

NEW YORK, N. Y.—The Ambato Electric Light Company has been incorporated with a capital stock of $50,000 for the purpose of establishing an electric light, heat and power company in Equador, South America. The incorporators are: F. J. Torpey, J. A. Caras and A. Manley, of New York, N. Y.

SUMMERFIELD, N. C.—Articles of incorporation have been filed for the Farmers' Telephone Company, with a capital stock of $25,000, by C. W. Williams, R. O. Gamble and others.

CLEVELAND, OHIO.—The Ohio Home Telephone Company has been organized for the purpose of taking over the property of the United States Telephone Company, the independent long-distance telephone system in Ohio. The officers of the company are: William Christy, of Akron, Ohio; S. W. Harper, of Wheeling, W. Va., and H. A. Huxhurst, of Cleveland, Ohio.

TIFFIN, OHIO.—The Tiffin Consolidated Telephone Company has been incorporated with a capital stock of $100,000 by Jacob Fleck and others.

SEDAN, OKLA.—The Saddle Mountain Mutual Telephone Company has been chartered with a capital stock of $875 by Amos H. Thompson, A. B. Moiner, of Sedan, and C. M. Evatt of Saddle Mountain, Okla.

YALE, OKLA.—The Yale Electric & Refrigerating Company has been chartered with a capital stock of $10,000 by W. T. Canfield, G. W. Ballinger, F. M. Burdick and E. Covey.

ALLENTOWN, PA.—The Emaus Telephone Company has been chartered for the purpose of constructing and operating a telephone system in Lehigh and Berks counties. The incorporators are: Dr. H. T. Wickert, H. M. Knauss, C. F. Newcomer, C. H. Stoneback, C. D. Brown, Oscar Neumeyer and Ernest Ritter.

PENNSBURG, PA.—The Perkiomen Telephone & Telegraph Company has been organized, with the following officers: Oliver Schantz, president; Eugene Scholl, secretary, and George Hebner, treasurer. The company will be capitalized at $10,000.

PROSPECT, PA.—The Prospect Telephone Company has been organized with a capital stock of $18,000. The company has purchased the local equipment of the Portersville Telephone Company. The officers of the company are: Frank Coats, president; E. Watson, of Isle, Pa., vice-president; A. Bowers, of Prospect, Pa., secretary and treasurer.

SANDY SPRINGS, S. C.—Articles of incorporation have been filed for the Sandy Springs Rural Telephone Company by J. M. McElroy, H. C. Summers, Jr., J. D. Smith and others.

CORPUS CHRISTI, TEX.—The Corpus Christi Street & Interurban Railway Company has been incorporated with a capital stock of $100,000 by Daniel Hewitt, V. S. Heimly and Earl C. Heimly.

LEWISVILLE, TEX.—Articles of incorporation have been filed for the Lewisville Light & Power Company with a capital stock of $2,000 by Guy Bourland, Charles G. Thomas, J. M. Hendrix and others.

HUME, VA.—The Morven Telephone Company has been chartered with a capital stock of from $500 to $5,000. The incorporators are: James R. Green, of Markham, Va., president; E. Marshall Newton, of Hume, Va., secretary and treasurer; C. H. Corder, Edward Ambler and C. J. Yates, of Hume, Va.

QUINCY, WASH.—The Quincy County Telephone Company has been incorporated with a capital stock of $6,000 by E. O. Yeldell, E. I. Hoffman, A. Keigley, L. Chaffee, A. R. Smith, W. H. Virginia and J. B. Morrison.

KAUKAUNA, WIS.—Articles of incorporation have been filed for the Kaukauna Telephone Company with a capital stock of $5,000 by J. M. Jansen, E. T. O'Brien, C. E. Raught, J. J. Martens and F. M. Charlesworth.

TWO RIVERS, WIS.—The West Shore Telephone Company has been organized, with the following officers: Nelson LeClaire, president; G. Eggert, secretary, and Peter Schroeder, of Two Rivers, treasurer.

LONDON, ONT., CAN.—Articles of incorporation have been filed for the London & Lake Erie Railway & Transportation Company with a capital stock of $2,000,000. The company, which is successor to the Southwestern Traction Company, has asked for permission to acquire the Woodstock, Thames Valley & Ingersoll Electric Railway as part of its system and to construct railways from Brantford, through Paris to Woodstock, Ingersoll, London, Strathroy and Glencoe, and from Delaware to Lambeth and from Aylmer to St. Thomas. The company will also operate boats on Lake Erie from Port Stanley to Cleveland, Ohio. The directors are: W. K. George, Sidney Jones and George B. Woods, of Toronto, Ont.; Dr. Angus MacKay, of Ingersoll, Ont.; F. G. Rumball and John Purdom, of London, and Albert E. Thompson, Cleveland, Ohio.

Personal.

MR. STEPHEN D. FIELD has sold to the Western Union Telegraph Company his invention of a quadrupled system for cable service. The system has been in use for some time on a cable between Key West and Havana.

MR. H. M. LEVYLIER has delivered a number of lectures before the Union Electricistas in Buenos Aires, Argentina, which have been published in book form by that society with the title "Nocione Elemantales de Electricidad Industrial."

PROF. SYDNEY W. ASHE, of Brooklyn, gave a lecture last Tuesday before the Baltimore N. E. L. A. section on underground conduit systems. Professor Ashe will lecture before the same body on Tuesday of each week until the middle of February.

PROF. CLARENCE E. REID has been appointed head of the Department of Physics and Electrical Engineering at the Mississippi Agricultural and Mechanical College. Professor Reid has, for the past four years, been assistant professor of Electrical Engineering at the Case School of Science, Cleveland.

MR. JOHN L. HALL, for a number of years New York manager for the Eck Dynamo & Motor Company, has associated himself with the Dilg Manufacturing & Trading Company, 401 to 425 East 163d Street, New York, as general sales manager. Mr. Hall has been connected with the electrical industry for more than 30 years, and during the past 15 years has served six years as district manager of the Bullock Electric Manufacturing Company; district manager of the Holtzer-Cabot Electric Company, with prior connections with the C. & C. Electric Company and the Crocker-Wheeler Company, as well as his recent connection with the Eck Company, noted above.

Obituary.

MR. EDWARD CURRY, formerly secretary and treasurer of the Staten Island Ferry and Railroad Companies, died at his home on Staten Island, N. Y., Nov. 17, in his 67th year. He was born near Peterboro, Ont., Canada, in 1843, and early in life became a telegraph operator and clerk on the Canadian Grand Trunk Railroad. In 1860 he was assistant manager of the Montreal Telegraph Company's office at Cobourg, and later became associated with the late Orrin S. Wood, Prof. Morse's first pupil, and was placed in charge of the Northwestern Telegraph Company's office at St. Paul, Minn. While in St. Paul Mr. Curry made a record for rapid telegraphy. He afterward filled important official positions with the Northwestern Company. He came East 25 years ago and organized the State Island Ferry and Railroad companies, with which he was identified until two years ago, when he retired from business on account of ill-health. The deceased is survived by a widow and four sons.

Trade Publications.

LINE MATERIALS are briefly outlined in an illustrated mailing folder issued by the Ajax Line Material Works, South Milwaukee, Wis.

MOTOR APPLICATIONS.—Bulletin No. 88 of the Wagner Electric Manufacturing Company, St. Louis, Mo., is a 32-page publication filled with illustrations of motor applications to various classes of work.

STORAGE BATTERIES.—The Electric Storage Battery Company, Philadelphia, has issued handbook IP, devoted to storage batteries in small isolated lighting plants. Handbook LV of the same company deals with storage batteries for low-voltage isolated lighting plants with tungsten lamps.

RHEOSTATS.—Direct-current motor-starting rheostats is the subject of Bulletin No. 4687, issued by the General Electric Company, which illustrates and describes rheostats designed for the reliable and efficient starting of direct-current motors. These rheostats are not intended for regulating the motor speed.

AIR BRAKES.—The increase in the use of short trains during rush hours and during periods of congested traffic on electric railways which normally operate single cars, and the necessity of a suitable air brake equipment for this service, resulted in the development of the emergency straight air brake system by the General Electric Company. A description of this system is given in detail in Bulletin No. 4701.

PORTABLE INSTRUMENTS.—Circular No. 1181 of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., describes a complete line of portable direct-current ammeters and voltmeters which are of the permanent-magnet and moving-coil type. These meters are of the single-air-gap construction for which permanency of calibration is claimed.

CONDUIT.—The National Metal Molding Company, Pittsburgh, Pa., has issued a two-color folder outlining the advantageous features of Sherarduct conduit. The pipe used for the conduit is subjected to a process in which zinc dust is anchored and impregnated uniformly into the metal over all parts, on both the interior and exterior. The pipe is then given a bath in hot paraffine, which enables it to resist in addition to ordinary corrosion the action of acids found in cinder concrete and building materials.

MOTOR-DRIVEN AIR COMPRESSORS.—The use of the air brake which is a natural result of the adoption of heavy cars not only for interurban but for city traffic is, as is well known, constantly increasing, and the old method of supplying compressed air from storage tanks on the car is being rapidly superseded by the modern and far safer method of employing motor-driven air compressors automatically operated and forming a part of the brake equipment. Bulletin No. 4699, of the General Electric Company, is devoted to a description of motor-driven air compressors which eliminate to a large extent at least, the objectionable features inherent in this type of machine.

Business Notes.

TAKATA & COMPANY, exporters to Japan, have moved their offices to the Hudson Terminal Buildings, 50 Church Street, New York.

J. G. WHITE & COMPANY have opened a branch office in the First National Bank Building, Chicago, Ill., with Mr. Charles T. Mordock as manager.

GAS-PRODUCER PLANT.—The Minneapolis Steel & Machinery Company is furnishing one of its Muenzel producer-gas engines and gas-producer plants for the electric light plant at Milbank, S. D., which is owned by Oscar Claussen, consulting engineer, St. Paul, Minn.

THE W. P. CARSTARPHEN ELECTRIC COMPANY, of Denver, Colo., is having plans made for a four-story building which will include departments for the manufacture of panel boards and cabinets and for storage battery work; a wiring and a contractors' supply department, and an electric garage. The roof of the building is planned for an aeroplane landing platform.

THE ESTERLINE ELECTRICAL COMPANY, of Lafayette, Ind., has closed a contract to install the electric generating equipment in the new plant of the American Box-Ball Company in Indianapolis. The contract calls for a complete set of motor drives for all of the machinery. The company has also secured the contract for an electric light and power plant for the Indiana Institute for the Deaf and Dumb just being completed at Indianapolis.

THE OLIVER ELECTRIC & MACHINE COMPANY, Birmingham, Ala., has succeeded the Oliver Electric Company, but with no change in the personnel of the company. The shop and office are now located at No. 1 South Twentieth Street, where larger quarters and additional machinery give greatly increased facilities for prompt and satisfactory service. In addition to its regular line, rewinding and rebuilding electrical machinery, the company is now giving special attention to engineering work, machine work and the sale of new and rebuilt machinery.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 16, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

939,969. INCANDESCENT ELECTRIC LIGHT; J. T. Bigger, Owensboro, Ky. App. filed April 17, 1908. Low and bright light by providing plug with two contacts, each forming a terminal for the respective filaments.

939,973. BLOCK SIGNALING SYSTEM; F. F. Brush, Detroit, Mich. App. filed Aug. 26, 1907. Employs a trip actuated by wheels of train to operate a recording mechanism.

939,984. ELECTRIC RAILWAY SIGNALING APPARATUS; W. J. Cook, Denver, Col. App. filed July 13, 1908. If rocks break the rails, this closes a circuit which releases a signal allowing the latter to assume the danger position.

939,995. CURRENT COLLECTOR; G. R. Forster, Fifthian, Ill. App. filed June 15, 1908. Two trolley wheels are mounted tandem at the top of the pole. Improvements in lubrication therefor.

940,002. CLUTCH; T. H. Gerrard, Troy, N. Y. App. filed April 10, 1908. Clutch for feeding carbon in an arc lamp. A pair of clutch rings are carried by a lifting bell crank.

940,008. COMBINED PRIMARY AND SECONDARY BATTERY SYSTEM; J. H. Gugler, Milwaukee, Wis. App. filed June 17, 1909. For distributing end cells by a multipolar switch.

940,012. CONNECTOR; T. A. Hammon, Passaic, N. J. App. filed March 18, 1908. Terminal connector for batteries formed from a single blank of metal will control shank having perforated gripping jaws at each end.

940,021. LUMINOUS ELECTRIC HEATER; W. F. Howard, West Ealing, and A. B. Cousins, Abingdon-on-Thames, England. App. filed Feb. 1, 1909. A vacuum bulb of glass containing a carbon filament mounted in massive metal terminals.

940,028. THIRD RAIL ELECTRIC RAILWAY SYSTEM; C. Kozesnik, New York, N. Y. App. filed April 25, 1908. The third rail has a box-shaped bottom in which are placed armature supports of insulating material.

940,034. WIRE SUPPORTING DEVICE; J. M. Leadon, Jr. App. filed Feb. 24, 1909. A flattened ring upon each end of a wire, the rings being flexible to clasp the wire.

940,043. SECONDARY BATTERY; W. Morrison, Chicago, Ill. App. filed June 8, 1903. A zinc battery with alkaline electrotype, the zinc being deposited on a wire screen forming the electrotype.

940,112. MOTOR CONTROL SYSTEM; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Sept. 11, 1907. The field and armature are connected in series and the armature of the dynamo is connected in shunt to the motor field. Means are provided connecting the motor to a source of current, for short circuiting it and for varying the armature voltage of the motor.

940,151. RESISTANCE UNIT; H. E. Heath, Lynn, Mass. App. filed Oct. 3, 1906. A sheet of flexible heat refractory material rendered partially conductive by a deposit of metal on the inner fiber thereof.

940,164. MOTOR CONTROLLING DEVICE; C. D. Knight, Schenectady, N. Y. App. filed Jan. 21, 1907. For printing presses running at variable speed. The starting rheostat is so connected that the speed is automatically brought to running value for a definite point of the rheostat. The speed is varied by varying the field strength of the motor.

940,174. COMBINED SWITCH AND FUSE PLUG; F. Mackintosh, Schenectady N. Y. App. filed Sept. 30, 1907. A perpendicular blade switch composed of two sections with ends overlapping and insulation between, the end being clamped together.

940,176. LIGHTNING ARRESTER; C. T. Mason, Sumter, S. C. App. filed May 1, 1908. For telephone circuits. A coil wound with abrupt turns inside a grounding block.

940,209. ATTACHMENT FOR MERCURY LAMPS; C. P. Steinmetz, Schenectady, N. Y. App. filed Oct. 22, 1904. For starting mercury lamps having self-reducing resistance device in shunt with the clamp.

940,211. ELECTRIC RAILWAY SYSTEM; W. M. Stephens, Philadelphia, Pa. App. filed Jan. 4, 1907. Feed wire and contact boxes in which contact elements are located controlled by an armature actuated by a magnet on the car.

940,220. LIGHTNING ARRESTER; E. W. Vogel, Chicago, Ill. App. filed May 5, 1906. For telephone, etc. Has an insulating base, a pair of posts of conducting material, a conducting coil between them and a ground wire near the coil.

940,241. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; A. C. Eastwood, Cleveland, Ohio. App. filed Dec. 3, 1908. A series of electrically operated switches, a control circuit, adjacent pairs of switches having one end of their windings connected to opposite sides of the control circuit and the other end of the windings connected to a control conductor.

940,266. MAGNETIC SEPARATOR; W. B. Moore, Walla Walla, Washington. App. filed Sept. 23, 1907. A tank, a rotating electromagnet therein carrying a wall with its upper portion flared outwardly.

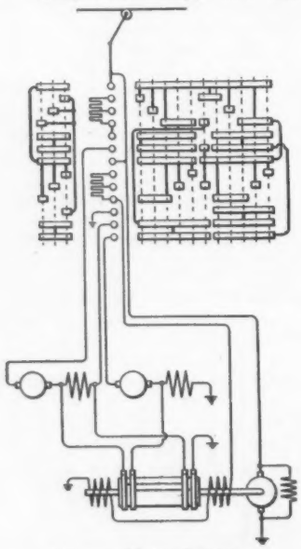
940,282. ELECTRIC SEPARATOR; G. D. Rogers, Gloucester, Mass. App. filed Dec. 30, 1905. A polyphase coil in ring form allows a stream of magnetic material to pass through it. The rotary field produces the separation.

940,288. STORAGE BATTERY; A. O. Tate, Toronto, Ont., Canada. App. filed Feb. 24, 1908. The anode strips are bound together in one plate and the cathode strips in an independent plate so that each plate may be used separately.

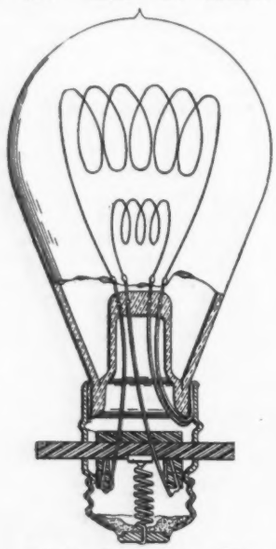
940,309. TROLLEY HEAD; B. F. Foss, Fairfield, Me. App. filed April 7, 1909. A trolley wheel and fork to do away with wear on the bushing by holding the pin in a bearing of large area.

940,311. COMBINATION SWITCH AND BLOW-OUT; W. C. Hafemeister, Cleveland, Ohio. App. filed July 12, 1907. An electric switch with means for blowing out the arc.

940,318. ELECTRIC MEASURING INSTRUMENT; A. H. Hoyt, Penacook, N. H. App. filed Oct. 18, 1907. Ampere and boltmeter



940,112—Motor Control System.



939,969—Incandescent Electric Light.

mounted on a common base with circuits so arranged that either instrument may be thrown in.

940,319. ELECTRIC MEASURING INSTRUMENT; A. H. Hoyt, Penacook, N. H. App. filed Jan. 20, 1908. A permanent magnet and moving coil instrument. Details.

940,328. ELECTRIC SWITCH; O. M. Knoblock, South Bend, Ind. App. filed March 6, 1907. A knife switch on an insulating base. Details.

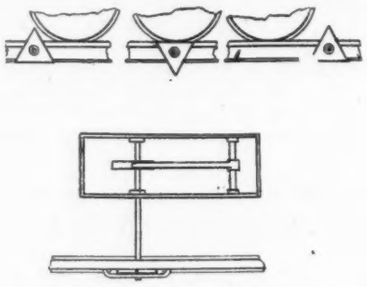
940,335. BINDING POST; H. E. Leppert, New Britain, Conn. App. filed Feb. 25, 1909. For switches. A stationary post with two opposing walls and screw passing through one wall to clamp the conductor against the other wall.

940,392. ELECTRIC GENERATOR; E. T. Kenney, Indianapolis, Ind. App. filed April 16, 1908. Improved magnets with laminated core having three way wings, staggered, and a pair of pole pieces coacting therewith at every 60 deg.

940,393. BRUSH HOLDER; E. R. Knight, Norwood, Ohio. App. filed Aug. 30, 1905. Brush holder of sheet metal stampings with a sheet metal spacing plate having a curved portion and a guiding portion for the brush.

940,397. BINDING POST; A. Lungen, New York, N. Y. App. filed Jan. 16, 1909. For stranded conductors consisting of a post, screw and traveling nut on the screw.

940,408. DOUBLE ACTING SWITCH; C. J. Spellman, Wauwatosa Wis. App. filed Dec. 7, 1908. A pair of stationary mercury cups, a movable mercury cup and depending arms dipping within the pair of cups and stationary contacts dipping within the third cup when the movable cup withdraws the contact arms from the pair of cups.



939,974—Railway Signaling Apparatus.

940,410. PENDULUM ACTUATED CLOCK; E. W. Vaill, Jr., Englewood, N. J. App. filed June 17, 1909. The pendulum is driven by an electromagnet and carries an oscillating weight whose oscillations are prevented when the vibrations of the pendulum are less than a certain amount, the weight closing a circuit when the weight ceases to operate.

940,444. VISUAL SIGNAL APPARATUS; R. Einbigler, New York, N. Y. App. filed April 8, 1909. For stock exchanges, etc., having an annunciator board with a name plate for the person called, station plates, electromechanisms for actuating them.

940,471. PROCESS OF RECOVERING TIN FROM WASTE; A Nodon, Bordeaux, France. App. filed April 9, 1908. Treats the waste with a solution of stannic sulfate having an excess of sulfuric acid mixed with ammoniacal stannic bichlorid and electrolyzing the resultant liquor.

940,487. ELECTROMAGNETIC TRACTION SYSTEM; G. L. Stanbro and A. D. Wagner, Norfolk, Va. App. filed June 7, 1906. Surface contract railway with a contact plate for feeding the car having a hollow supporting stem, a normally open switch inclosed by the stem, a second normally open switch in series therewith and a magnet on the car for operating the switches one after the other.

940,511. MOTOR VEHICLE; F. E. Chase, Schenectady, N. Y. App. filed Oct. 10, 1906. High speed car using two trolley poles engaging one wire but dependent on each other, a plurality of motors and a controller with means for connecting the controllers in independent motor circuits.

940,525. SAFETY DEVICE FOR OVERHEAD ELECTRIC CONDUCTORS; E. Giraud, Paris, France. App. filed Oct. 4, 1906. An insulator carrying a metal piece with an offset carrying a member for receiving the conductor with a short circuiting device adjacent to the insulator for carrying the current when the conductor is severed.

940,526. ELECTRICAL RECEPTACLE; G. W. Goodridge, Bridgeport, Conn. App. filed May 6, 1909. Screw shell for sockets of lamps having securing flanges, portions of the shell being bent over on the flanges to reinforce them.

940,535. BURGLAR ALARM; M. Korbel, Kingston, Pa. App. filed May 17, 1909. A yieldable safe support normally flush with the floor line to close the circuit when the burglar steps on it.

940,550. APPARATUS FOR STARTING ELECTRIC MOTORS; S. B. Paine, Newton, Mass. App. filed May 28, 1909. A plurality of motors are connected in parallel to three conductors, a switch being in series with each motor and the conductors will overload tripping devices for the switches.

940,555. SUSPENSION DEVICE FOR TELEPHONE AND TELEGRAPH CABLES AND OTHER ELECTRICAL CONDUCTORS; E. C. Read, Franklin, Pa. App. filed Nov. 25, 1908. A strap formed of two clips with ends detachably secured together.

940,561. TAPPING FURNACE; G. O. Seward, Holcombs Rock, Va. App. filed May 3, 1904. Electric furnace in which the tap hole is closed by a rod which can be melted out by an electric arc.

940,574. TROLLEY HARP; J. T. Archer, Champaign, Ill. App. filed Nov. 18, 1908. A trolley pole carrying a rotatable standard in which the wheel is mounted.

940,578. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; S. R. Bergman, Lynn, Mass. App. filed Oct. 13, 1905. An oil bath lightning arrester in which a plurality of conductive plates are mounted, adjacent to a fair-shaped plate on a rotary stem.

940,610. GAS LIGHTING AND EXTINGUISHING APPARATUS; V. C. J. Nightingall, Melbourne, Victoria, Australia. App. filed June 8, 1909. For street lamps. A plurality of revolving segmental switches are operated simultaneously by variation of gas pressure.

940,632. DYNAMO-ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed Nov. 27, 1905. Multiphase generator of rotating field type with insulated bolts on the end member for supporting the end turns and end connections.

940,635. ELECTRODE ELEMENT FOR STORAGE BATTERIES; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed Feb. 6, 1908. An electrode element comprising a perforated tubular pocket with a spiral joint containing compressed active material.

940,645. SWITCH; L. H. Moulthrop, Bridgeport, Conn. App. filed Sept. 12, 1908. Two part button snap switch. Improvement in the escapement for the contact member.

940,647. AUTOMATIC MAGNETIC CIRCUIT BREAKER; W. M. Scott, Philadelphia, Pa. App. filed Jan. 19, 1907. An operating handle with force multiplying mechanism between the handle and the switch controls heavy currents.